

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION 5

#3066

DATE: SEPTEMBER 22, 2003

EPA Region 5 Records Ctr.



328400

SUBJECT: QAPP REVIEW REQUEST

FROM: RUSSELL HART PHONE: (312) 886-4844

TO: STEVE OSTRODKA, CHIEF  
FIELD SERVICES SECTION

Attached please find 1 copies of a QAPP for your review.

SITE NAME: SOUTHEAST ROCKFORD GROUNDWATER CONTAMINATION  
AREA 9/10

STATE: ILLINOIS

LEAD: FUND      PRP ☒ STATE     

SITE ACCOUNT# 05DKBE04 (SITE PROTECT # FOR OVERSIGHT OF PRP RD)  
EFFORTS AT AREA 9/10

PHASE/STAGE: RI/FS, RD, RA OTHER     

QAPP REVISION NO.: 1 (INITIAL REV. IS '0')

QAPP PREPARED BY: SECOR INTERNATIONAL, INC.

PRE-QAPP MEETING? YES/NO MTG. DATE: (FEB. 2003)

REQUESTED REVIEW TIME:

     INITIAL REVISION, UP TO 21 DAYS  
☒ 1ST REVISION, UP TO 14 DAYS  
     2ND REVISION, ADDENDUMS, ETC. 07 DAYS\*

EXPEDITED REVIEWS WILL NEED A MEMO FROM BRANCH CHIEF

ENCLOSURE/OTHER DOCUMENTS: LETTER (9/18/03) PROVIDING RESPONSE TO  
AGENCY REVIEW COMMENTS OF 8/21/03; PLUS  
NEW QAPP SIGNATURE PAGE (ADDS QA CONTROL  
OFFICER SIGNATURE); PLUS OTHER  
REV. #1 QAPP PAGES  
FOR WHICH AMENDMENT  
IS NECESSARY

WORKPLAN SAMPLING PLAN ☒ SOPs SAS

COMMENTS: AS REQUESTED IN AGENCY'S  
8/21/03 REVIEW)

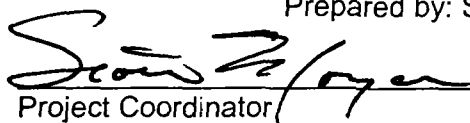
TO BE FILLED IN BY FSS: DATE IN: 9/22/03  
DATE DUE:       
FSS LOG-IN NO.:     

\*TURNAROUND TIMES OF 7 DAYS OR LESS WILL BE DETERMINED ON WORKLOADS, DEADLINES OR  
OTHER CONSTRAINTS ON RPM OR FSS REVIEWER.

QUALITY ASSURANCE PROJECT PLAN ADDENDUM  
FOR THE  
AS/SVE  
REMEDIAL DESIGN  
SE ROCKFORD AREA 9/10  
WINNEBAGO COUNTY, ILLINOIS  
(Revision 1)

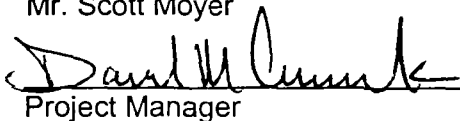
September 10, 2003

Prepared by: SECOR International Incorporated

  
Project Coordinator

Mr. Scott Moyer

9/11/03  
Date

  
Project Manager

Mr. David Curnock

9/10/03  
Date

  
Quality Assurance Manager/Project Quality Control Officer

Mr. Brad Barquest

9/11/03  
Date

\_\_\_\_\_  
U.S. EPA Region 5 Remedial Project Manager  
Mr. Russell Hart

\_\_\_\_\_  
Date

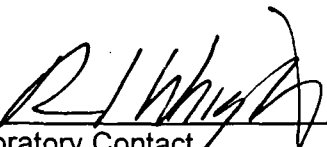
\_\_\_\_\_  
U.S. EPA Region 5 Quality Assurance Reviewer  
Ms. Alida Roberman

\_\_\_\_\_  
Date

**QUALITY ASSURANCE PROJECT PLAN ADDENDUM  
REMEDIAL DESIGN  
SE ROCKFORD AREA 9/10  
WINNEBAGO COUNTY, ILLINOIS  
(Revision 1)**

September 10, 2003

Prepared by: SECOR International Incorporated

  
\_\_\_\_\_  
Laboratory Contact  
Mr. Richard Wright

9/16/03  
Date

<b>TABLE 2</b> <b>Sample Matrix, Frequency, and Analytical Levels for the Pilot Test</b> <b>Remedial Design</b> <b>Area 9/10</b> <b>Rockford, Illinois</b>								
Medium	Method	Data Package Level	Sample No.	Dup. Sample	Field (Rinse) Blanks	Trip Blanks	Matrix Spikes	Notes
Groundwater (VOCs)	SW846 Method 8260B	2	22	2	(c)	(a)	5%	(b)
Soil gas (VOCs)	USEPA Methods 18/TO-15	2	44	3		(a)		(b)
Soil Gas Methane, CO <sub>2</sub> , O <sub>2</sub>	Field Measurement		34					
Groundwater (Redox)	Field Measurement		34					
Groundwater (dissolved oxygen)	Field Measurement		34					
Groundwater (dissolved CO <sub>2</sub> )	Field Measurement		34					
Groundwater (pH)	Field Measurement		34					
Soil Gas (Helium)	Field Measurement		60					

Notes:

- (a) One trip blank will be included in each sample cooler submitted to the laboratory for VOC analysis only.
- (b) Duplicates will be collected at a rate of 1 per 20 samples. The samples will be selected randomly by field staff.
- (c) One rinse blank per representative activity will be collected for groundwater VOCs.



Illinois. Previously existing monitoring points may also be re-surveyed to help assure accurate baseline elevation data. Sample ports for the SVE system will be displayed on the SVE schematic.

### **Data Report Packages**

Data report packages from the laboratory will be Standard Data Deliverable Package (Data Package Level 2) including:

- **Cover Page:** This page must contain the name, address and phone number of STL Knoxville, the name and address of the client, the lot/SDG number, the signature of the STL Knoxville project manager and the date the report was issued.
- **Case Narrative:** In addition to the technical and quality issues described by each laboratory group, the compiled narrative contains the following information:  
If samples were subcontracted to another laboratory (STL or non-STL laboratory), a statement describing which analyses were subcontracted must be added to the narrative. All narratives must adequately describe deviations or state that no deviations occurred. The narrative must contain a summary of the laboratory's certifications.
- **Sample Information:** LIMS Sample Summary (Lab and Client ID).
- **Results:** Sample results by method.
- **Laboratory Chronicle (LabChron):** A summary of the method, run number, batch number, and date and time of analysis.
- **Quality Control (Default QC Types – Preparation Batch QC Reported)**
- **Quality Assurance Methods References and Notes**
- **Chain-of-Custody:** Sample Receipt Documentation (Chain-of-custody forms, condition upon receipt (CUR) forms, and any client provided receipt documentation).

**APPENDIX A**  
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## SOP FOR HACH INSTRUMENTS DIGITAL TITRATOR (OR EQUIVALENT)

### **Purpose**

The concentration of carbon dioxide (CO<sub>2</sub>) in groundwater can be estimated using a digital titrator. This SOP summarizes the procedure for utilizing a Hach Digital Titrator with Sodium Hydroxide (NaOH). Note that this procedure references the attached documentation provided by Hach.

### **Procedure**

1. Select a sample size and a NaOH Titration Cartridge corresponding to the expected CO<sub>2</sub> concentration (refer to Table provided by manufacturer). If the expected concentration is unknown, start with a smaller sample volume and determine its approximate concentration. Retest with the appropriate sample size.
2. Insert the appropriate titration cartridge into the Titrator receptacle and lock it in position with a slight turn.
3. Remove the polyethylene cap from the end of the cartridge and insert a clean delivery tube.
4. When a cartridge is first attached to the digital Titrator, the piston must be engaged and the delivery tube must be flushed. Holding the Titrator with the tip of the cartridge pointing up, push the plunger release button in and toward the cartridge. Turn the delivery knob until the air is expelled and several drops of titration fluid flow from the tip. Reset the counter to zero, then wipe or rinse the tip with deionized water.
5. Collect the appropriate groundwater sample volume into an Erlenmeyer flask.
6. Add the contents of one phenolphthalein indicator powder pillow or 4 drops of phenolphthalein indicator solution and mix. If a pink color forms, no CO<sub>2</sub> is present.
7. Immerse the delivery tube tip into the solution and swirl the flask gently while titrating with NaOH from colorless to a light pink color that persist for 30 seconds. Inaccurate results will be obtained if the delivery tube tip is not immersed in the solution.
8. Record the number of digits that appear in the digital counter window
9. Calculate the concentration as follows:

Number of digits X digit multiplier = CO<sub>2</sub> concentration (mg/L)

The digit multiplier is included in a table provided by the manufacturer.

10. Upon completion, press the plunger release button and manually retract the plunger into the body of the Titrator. Remove the cartridge. Remove the delivery tube and reseal the cartridge with the polyethylene cap.
11. Discard or clean the delivery tube immediately after use.

### **Sample Collection**

1. Collect samples in clean plastic or glass bottles.
2. Avoid excess agitation or prolonged exposure to air.

3. Analyze samples as soon as possible after collection.
4. If immediate analysis is not possible, the samples may be stored for 24 hours or less by cooling to 4° C or below. Warm samples to room temperature before analysis.
5. Highly colored or turbid samples may mask the color change of the end point. For these samples, titrate to a pH of 8.3 using a pH meter.

### **Solution Check**

Sodium hydroxide standard solutions lose strength with age and should be checked periodically by titrating a known standard. Check the solution by titrating 50 ml of Potassium Acid Phthalate standard solution, 100 mg/L CO<sub>2</sub>, using Phenolphthalein Indicator solution. The titration should require 5.00 ml of titrant. If the volume required is greater than 5.25 ml, discard the sodium hydroxide and replace with a fresh supply.

### **Accuracy Check**

#### **Standard Additions Method**

This accuracy check should be performed when interferences are suspected or to verify analytical technique.

1. Snap the neck off a Carbon Dioxide Voluette Ampule Standard for Carbon Dioxide, 10,000 mg/L CO<sub>2</sub>.
2. Use a TenSette Pipet (Cat. No. 19700-01) to add 0.1 mL of standard to the sample titrated in step 6. Resume titration back to the same end point. Record the number of digits required.
3. Repeat, using additions of 0.2 mL and 0.3 mL. Titrate to the same end point after each addition.
4. Each 0.1 addition of standard should require 50 additional digits of 0.3636 N titrant or five digits of 3.636 N titrant. If these uniform increases do not occur, refer to Section 3.2.2 (Standard Additions) of the Operating Instructions Manual.

### **Required Reagents (varies with sample characteristics)**

<b>Description</b>	<b>Unit</b>	<b>Cat. No.</b>
Carbon Dioxide Reagent Set (about 100 tests).....		22727-00
Includes:		
Phenolphthalein Powder Pillows.....	100/pkg.....	942-99
Sodium Hydroxide Titration Cartridge, 0.3636 N.....	each.....	14378-01
Sodium Hydroxide Titration Cartridge, 3.636 N.....	each.....	14380-01
Water, deionized.....	4 L.....	272-56

### Required Apparatus

Digital Titrator .....each..... 16900-01

Select one or more based on sample concentration:

Flask, Erlenmeyer, 250-mL.....each..... 505-46

Flask, Erlenmeyer, 125-mL.....each..... 505-43

### Required Standards

Carbon Dioxide Standard Solution, Voulette® Ampule,

10,000-mg/L as CO<sub>2</sub>, 10-mL..... 16/pkg..... 14275-10

Phenolphthalein Indicator Solution, 5-g/L..... 100 mL MDB..... 162-32

Potassium Acid Phthalate Standard Solution, 100-mg/L as CO<sub>2</sub> 100 mL.....2261-42

## Method 8205

## Digital Titrator Method Using Sodium Hydroxide

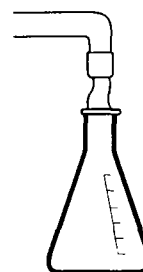
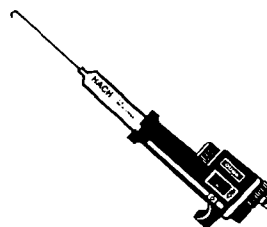
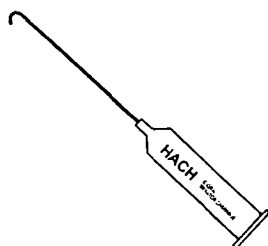
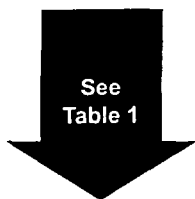
(10 to 1000 mg/L as CO<sub>2</sub>)

### Digital Titrator

Scope and Application: For water and seawater



- For added convenience when stirring, use the TitraStir apparatus (Cat. No. 19400-00, -10).
- For more accurate results, check the calibration of the Erlenmeyer flask. Fill a graduated cylinder with the sample volume of deionized water. Pour the water into the Erlenmeyer flask and mark the proper level with a wax pencil or permanent marker.
- Four drops of Phenolphthalein Indicator Solution (Cat. No. 162-32) can be substituted for the Phenolphthalein Indicator Powder Pillow.
- Minimize agitation of the sample to avoid loss of carbon dioxide.



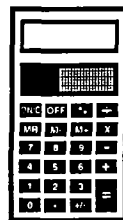
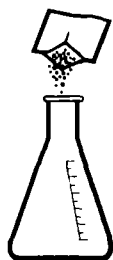
1. Select a sample size and a Sodium Hydroxide (NaOH) Titration Cartridge in *Table 1* that correspond to the expected carbon dioxide (CO<sub>2</sub>) concentration.

2. Insert a clean delivery tube into the titration cartridge. Attach the cartridge to the titrator body.

3. Turn the delivery knob to eject a few drops of titrant. Reset the counter to zero and wipe the tip.

4. Collect a water sample directly into the titration flask by filling to the appropriate mark.

# Carbon Dioxide



5. Add the contents of one Phenolphthalein Indicator Powder Pillow and mix.

If a pink color forms, no carbon dioxide is present.

6. Place the delivery tube into the solution and swirl the flask gently while titrating with sodium hydroxide from colorless to a light pink color that persists for 30 seconds (pH 8.3). Record the number of digits required.

7. Calculate:

Total Digits Required x Digit  
Multiplier = mg/L as CO<sub>2</sub>

Table 1

10-50	200	0.3636	14378-01	0.1
20-100	100	0.3636	14378-01	0.2
100-400	200	3.636	14380-01	1.0
200-1000	100	3.636	14380-01	2.0

## Interferences

Highly colored or turbid sample may mask the color change of the end point. Use a pH meter (Cat. No. 51700-10) for these samples, titrating to pH 8.3. Other acid components in the sample will be titrated and interfere directly in this determination.

Sodium hydroxide standard solutions tend to lose strength slowly with age and should be checked periodically by titrating a known standard. Check the solution frequently (monthly) by titrating 50 mL of Potassium Acid Phthalate Standard Solution, 100 mg/L CO<sub>2</sub>, using Phenolphthalein Indicator Solution. The titration should require 5.00 mL of titrant. If the volume required for this titration is greater than 5.25 mL, discard the sodium hydroxide and replace it with a fresh supply.

## Sampling and Storage

Collect samples in clean plastic or glass bottles. Fill completely and cap tightly. Avoid excessive agitation or prolonged exposure to air. Analyze samples as soon as possible after collection. If immediate analysis is not possible, the samples may be stored for at least 24 hours by cooling to 4 °C (39 °F) or below. Before analysis, warm the samples to room temperature.

## Accuracy Check

### Standard Additions Method

This accuracy check should be performed when interferences are suspected or to verify analytical technique.

1. Snap the neck off a Carbon Dioxide Voluette Ampule Standard for Carbon Dioxide, 10,000 mg/L CO<sub>2</sub>.
2. Use a TenSette Pipet (Cat. No. 19700-01) to add 0.1 mL of standard to the sample titrated in step 6. Resume titration back to the same end point. Record the number of digits required.
3. Repeat, using additions of 0.2 mL and 0.3 mL. Titrate to the same end point after each addition.
4. Each 0.1 addition of standard should require 50 additional digits of 0.3636 N titrant or five digits of 3.636 N titrant. If these uniform increases do not occur, refer to *Section 3.2.2 Standard Additions* on page 46.

## Summary of Method

Acidity due to carbon dioxide in a sample is titrated with sodium hydroxide to a phenolphthalein end point. Strong acids are assumed to be absent or of insignificant concentration. See *Appendix A, Chemical Procedures Explained*.

### Required Reagents (varies with sample characteristics)

Description	Unit	Cat. No.
Carbon Dioxide Reagent Set (about 100 tests) .....		22727-00
Includes:		
Phenolphthalein Powder Pillows .....	100/pkg.....	942-99
Sodium Hydroxide Titration Cartridge, 0.3636 N.....	each .....	14378-01
Sodium Hydroxide Titration Cartridge, 3.636 N.....	each .....	14380-01
Water, deionized .....	4 L .....	272-56

### Required Apparatus

Digital Titrator.....	each.....	16900-01
Select one or more based on sample concentration:		
Flask, Erlenmeyer, 250-mL.....	each.....	505-46
Flask, Erlenmeyer, 125-mL.....	each.....	505-43

### Required Standards

Carbon Dioxide Standard Solution, Voluette® Ampule, 10,000-mg/L as CO <sub>2</sub> , 10-mL.....	16/pkg.....	14275-10
Phenolphthalein Indicator Solution, 5-g/L .....	100 mL MDB.....	162-32
Potassium Acid Phthalate Standard Solution, 100-mg/L as CO <sub>2</sub> .....	100 mL.....	2261-42

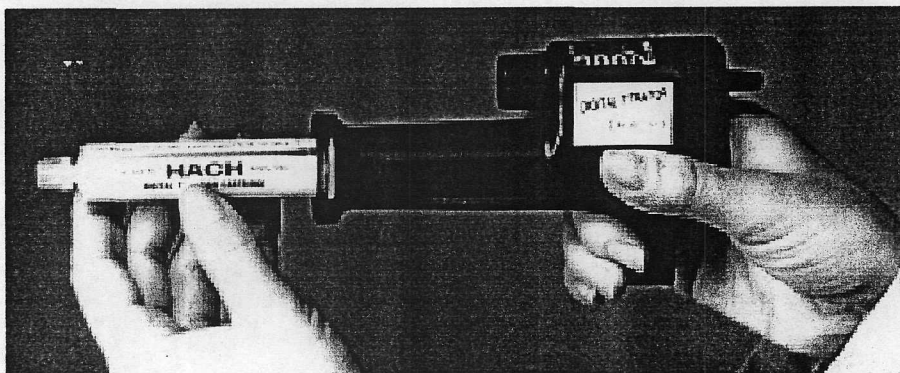


## 6.1 The Digital Titrator

To use the Digital Titrator:

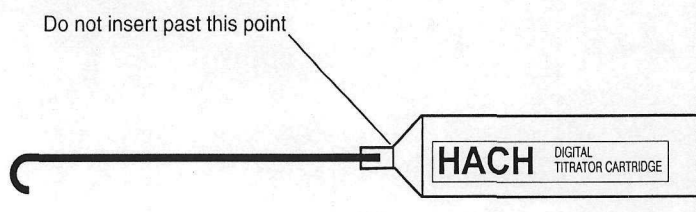
1. Estimate the expected sample concentration from the table given in each procedure and select a sample volume and titration cartridge accordingly.  
*Note: If the expected sample concentration is not known, start with a smaller sample volume and determine its approximate concentration. Retest with the appropriate sample size.*
2. Slide the cartridge into the titrator receptacle and lock it in position with a slight turn. See *Figure 1*.

Figure 1 Sliding the Cartridge into Place



3. Remove the polyethylene cap from the end of the cartridge and insert a clean delivery tube. See *Figure 2*. Use a delivery tube with a straight barrel for hand-held titrations; use a delivery tube with a 90° bend for stationary setups. Do not insert tube past the cartridge extension (see illustration below). Sometimes the tube may have a small burr on the leading edge that must be removed before it can be inserted.

Figure 2 Inserting the Delivery Tube



4. The Digital Titrator may be mounted on a support for stationary titrations; use a TitraStir® or a clamp holder and clamp to attach the titrator to a laboratory stand. (See *Figure 3* and *Figure 4*.) The TitraStir also stirs the sample at a constant speed, leaving the analyst free to detect the endpoint.
5. When a cartridge is first attached to the Digital Titrator, the piston must be engaged and the delivery tube must be flushed. To do this:
  - a. Hold the titrator with the tip of the cartridge pointing up. Advance the plunger release button to engage the piston with the cartridge (push the button in and toward the cartridge.)

Figure 3 Using the TitraStir

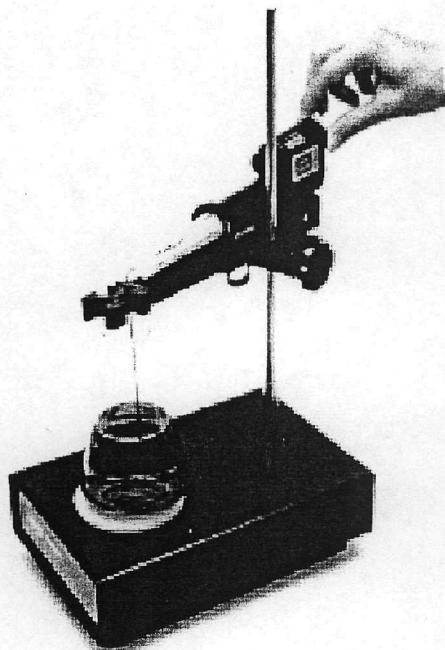
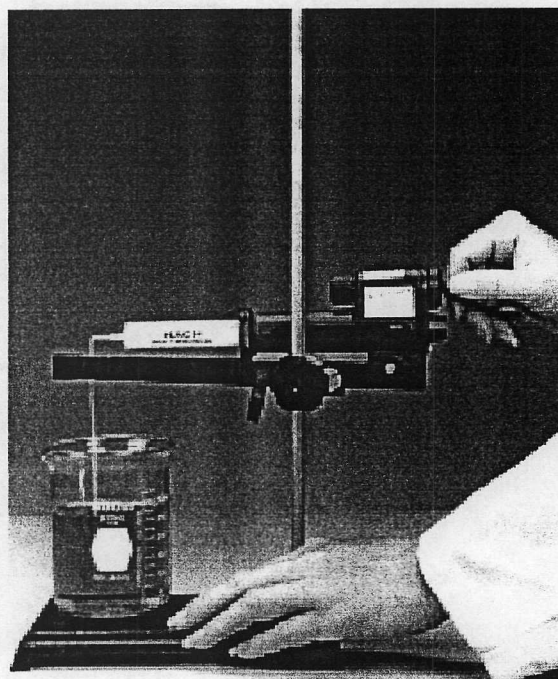


Figure 4 Using a Laboratory Stand



- b. Turn the delivery knob until all the air is expelled and several drops of solution flow from the tip.
- c. Use the counter reset knob to turn the digital counter back to zero. Wipe the tip, or rinse it with deionized water.
6. Measure the sample volume in the smallest appropriate graduated cylinder or pipette. Transfer the sample into a 125-mL or 250-mL erlenmeyer flask. Dilute with deionized water if necessary.

**Note:** Sample dilutions must be made accurately. However, final total volume of titrated solution is not critical.

7. Add the necessary reagents to the sample and swirl to mix.
8. Immerse the delivery tube tip in the solution and swirl the flask while titrating. Inaccurate results will occur if the delivery tube tip is held above the solution.
9. Titrate by turning the delivery knob. Keep turning the knob and swirling the sample until the end point is reached. Record the number of digits that appear in the digital counter window.

**Note:** The digital titrator procedures are designed so that the number of digits required will usually range from 100 to 400. If the digits required are less than 100 or more than 400, use an alternate sample volume or titrant cartridge.

10. Calculate the concentration of your sample by using the formula:

**Note:**  $\text{Digits Required} \times \text{Digit Multiplier} = \text{Sample Concentration}$

**Where:**

Digits Required = the number that appeared in the digital counter window in step 9.

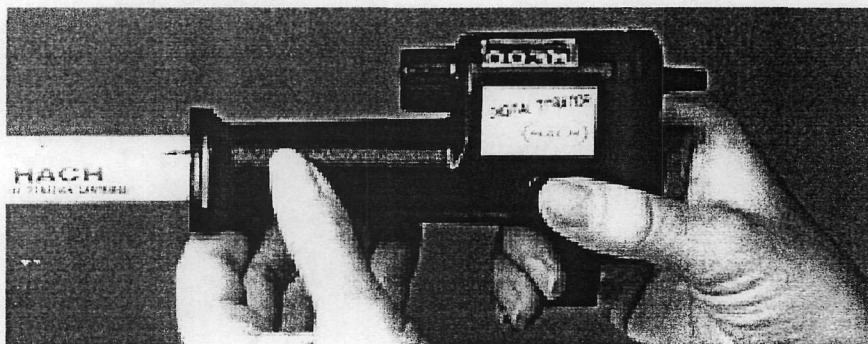
**Note:** Digit Multiplier = the number from the table given in the procedure. It takes into account the sample dilution and titrant strength.

**Figure 5    Titrating the Sample**



11. At the end the testing session, press the plunger release button and manually retract the plunger into the body of the titrator. Remove the cartridge. Remove the delivery tube and reseal the cartridge with the polyethylene cap. (See *Figure 6.*)

**Figure 6    Retracting the Plunger**



12. Discard or clean the delivery tube immediately after use. To clean, force water, then air, through the tube with a syringe or wash bottle.

**Optional Apparatus for Use with the TitraStir:**

Description	Quantity Required		Unit	Cat. No.
	Per Test			
Delivery Tubes, 90° with hook for TitraStir .....	1		5/pkg.....	41578-00
TitraStir Mixer/Stand Assembly,				
115 VAC .....	1		each.....	19400-00
230 VAC .....	1		each.....	19400-10
Stir Bar, 28.6 x 7.9 mm .....	1		each.....	20953-52
Flask, Erlenmeyer, 250-mL .....	1		each.....	505-46



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## 6.2 The TenSette Pipet

The TenSette Pipet comes with 100 disposable tips, and more can be ordered from Hach. Ideally, a new tip should be used for each dispensation, although it is acceptable to use the same tip several times when pipetting from the same solution. After several uses, however, the pipet tip may retain some liquid and cause inaccurate delivery.

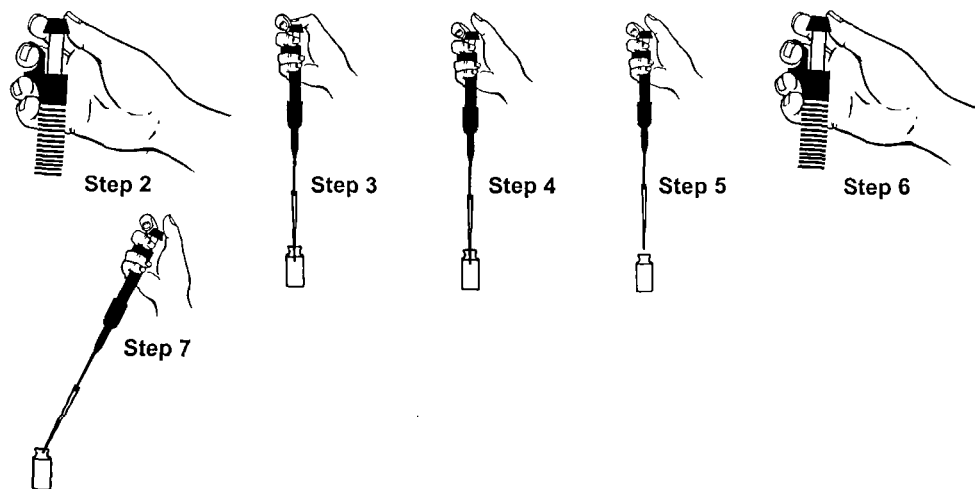
Always use careful, even hand movements. If the pipet does not operate smoothly, disassemble it and coat the piston and retainer with high-quality stopcock grease. Also coat the metering turret lightly with grease. Refer to the TenSette Pipet manual.

The solution being pipetted should be at room temperature (20–25 °C).

Never lay the pipet down while there is liquid in the tip. Some of the solution might leak into the pipet and corrode it.

### 6.2.1 Operating the TenSette Pipet

1. Attach a clean tip by holding the pipet body in one hand and gently pressing the large end of the pipet tip onto the tapered end of the pipet. Be sure to get a good seal.
2. Turn the turret cap to align the desired volume with the mark on the pipet body.
3. Using a smooth motion, press down on the turret cap until it reaches the stop. Immerse the tip about 5 mm ( $\frac{1}{4}$  inch) below the solution surface to avoid drawing air into the pipet. Do not insert the tip too deep.
4. While maintaining a constant pressure, allow the turret to return slowly to the extended position. A rapid return may affect the delivery volume.
5. With the turret up, take the tip out of the solution and move it to the receiving vessel. Do not press on the turret cap while moving the pipet.
6. Use your thumb and forefinger to twist the turret cap to the next higher volume position to ensure quantitative transfer of the sample. The "F" position provides full blowout.
7. With the tip in contact with the side of the receiving vessel, slowly and smoothly press down on the turret cap until it reaches the stop and the solution is completely discharged.



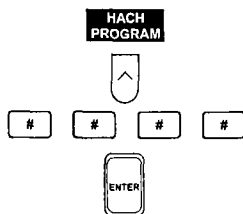
## 6.3 Spectrophotometers and Colorimeters

The following typical procedures are meant as an overview. Specific sample volumes, reagents, sample cells, and timing intervals vary depending on which procedure and which Hach instrument you are using. Refer to the procedure manual for your instrument for specific instructions.

### 6.3.1 The DR/4000 Spectrophotometer (Typical Procedure)



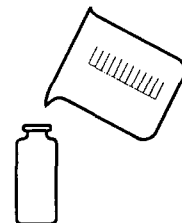
1. Install the correct sample cell adapter in the sample cell module.



2. Press the soft key under **HACH PROGRAM**. Enter the appropriate stored program number with the numeric keys. Press **ENTER**.



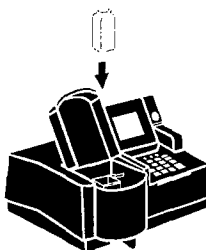
3. Prepare the sample and blank solution (if necessary) for measurement as described in the test procedure.



4. Fill a clean sample cell with the required amount of sample for the test (*the sample*). Add the appropriate reagents and mix.



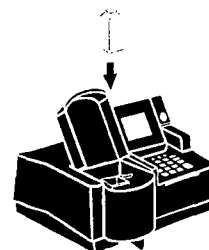
5. Fill another clean sample cell with the required amount of reagent blank (*the blank*). Add the appropriate reagents and mix.



6. Place the blank into the cell compartment and close the lid.



7. The display will read **ZERO**.

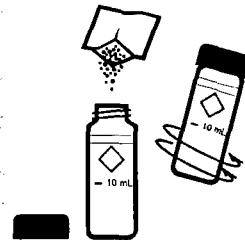
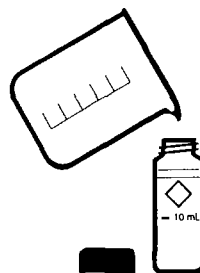


8. Remove the blank from the sample cell, replace it with the sample, and close the lid. The results will be displayed.

### 6.3.2 The DR/2500 Spectrophotometer (Typical Procedure)

**Hach Programs**

**See  
Procedures**

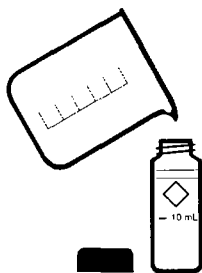


1. Touch  
**Hach Programs.**  
Select program  
Touch **Start.**

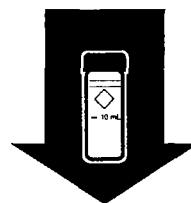
2. Prepare the sample  
and blank solution (if  
necessary) for  
measurement as  
described in the test  
procedure.

3. Fill a clean sample cell  
with sample.

4. Add the required  
reagents to the sample  
cell (the prepared  
sample). Swirl to mix.  
Activate the timer where  
required.



**Zero**



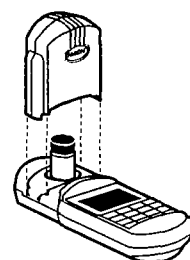
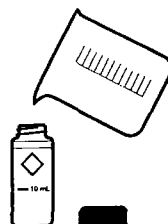
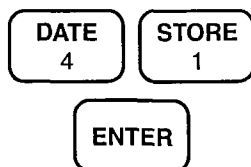
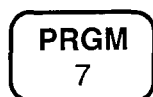
5. Fill a second sample  
cell with sample  
(the blank).  
Add the required reagents  
and mix.

6. When the timer  
beeps, place the blank  
into the cell holder.

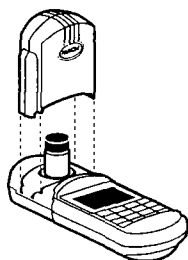
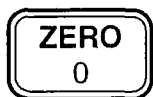
7. Touch **Zero.**  
The display will show:  
**0 mg/L**

8. Place the prepared  
sample into the cell  
holder.  
Results will appear  
in mg/L, or other  
specified units.

### 6.3.3 The DR/800 Colorimeter (Typical Procedure)

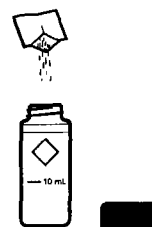
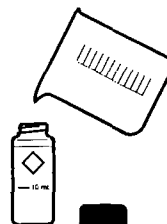


1. Press the **PRGM** key.
2. Enter the desired program number by pressing the numerical keys to display the program number.  
Press **ENTER**.
3. Prepare the sample for measurement as described in the applicable test procedure. If the reagent blank also needs treatment, prepare it at this time.
4. Place the sample cell containing the blank solution into the sample compartment



5. Zero the instrument by pressing the **ZERO** key. The display will count down to 0. Then the display will show zero concentration and the units concentration.
6. Place the sample cell containing the prepared sample into the sample compartment.
7. Press the **READ** key. The display will count down to zero. Then it will show the results in concentration units.

### 6.3.4 The Pocket Colorimeter (Typical Procedure\*)



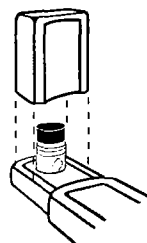
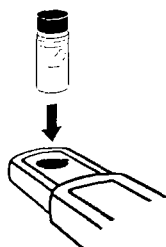
1. If your Pocket Colorimeter Instrument requires you to select a range before testing, read the *HI or LO Range Mode* section in the instrument manual, and set the appropriate range.

2. Fill a clean sample cell to the 10-mL mark with the blank solution (usually untreated sample).

3. Fill another clean sample cell to the 10-mL mark with sample.

4. Add the reagents and mix.

Wait the specified time period, where required.



5. Place the blank in the cell compartment with the diamond mark facing the keypad and cover the cell with the light shield.

**Note:** When covering the sample cell, place the curved surface of the light shield closest to the keypad to provide a good seal against stray light.

6. Press the **ZERO** key. After 2 seconds the display will read:

0.0

or

0.00

depending on the specified resolution.

7. Place the sample cell containing the sample into the cell compartment (diamond mark facing the keypad) and cover with the light shield.

8. Press the **READ** key. After about 2 seconds the instrument will display the results.

\* All instrument functions are performed using two keys and the digital display.



**SOP FOR YSI 600 XLM WATER QUALITY INSTRUMENT  
(OR EQUIVALENT)**

**Purpose**

To provide a maintenance and calibration procedure for the YSI 600 XLM.

**Materials and equipment required**

(4) AA batteries (SUP1000)  
pH 4 buffer solution (ORI1012)  
pH 7 buffer solution (ORI1013)  
pH 10 buffer solution (ORI1014)  
1mS/cm conductivity solution (YSI1014)  
Zobell solution (YSI1009)

**Procedure**

**Battery Replacement**

1. Grasp the sonde body with one hand and the battery cover with the other. Unscrew the battery cover and slide it up and over the bulkhead connector.
2. Remove the old batteries. Inset the new batteries, paying special attention to the polarity.
3. Check the O-ring and sealing surface for damage.
4. Apply a very thin coat of O-ring lubricant to the batter chamber O-rings.
5. Return the batter cover and tighten by hand. DO NOT OVER-TIGHTEN.

**Sonde Set-up Procedure with PC**

1. Connect the field cable to the db-9 connector on the PC. Use an adapter if needed.
2. Start the EcoWatch software by double clicking the EcoWatch for Windows icon.
3. Select the sonde icon from the toolbar, and then the proper Com port (1 or 2) to which your sonde is connected.
4. If the default setting is correct, it does not need to be changed. Click "OK" to open a terminal window.
5. A new window will open with a "#" symbol. Type "Menu" after the "#" symbol, press enter. The sonde main menu will now be displayed.

----- Main -----

- |             |            |
|-------------|------------|
| 1-Run       | 5-System   |
| 2-Calibrate | 6-Report   |
| 3-File      | 7-Sensor   |
| 4-Status    | 8-Advanced |

Select option (o for previous menu):

-----  
NOTE\* You can go back one screen at a time by using the **Esc** key.

### Setting the Date & Time

6. Select SYSTEM. Select DATE & TIME. Choose the time/date display format by pressing the number next to the format you want.
7. If the time needs adjusted, press 6. Input the time using the 24-hour clock format.
8. Select 4 so the date will be displayed as a 4-digit year.
9. If the date needs adjusted, press 5. Input the date using the mm/dd/yyyy format.
10. Press Esc to return to the System menu. Press Esc to return to the Main menu.

### Sensor Selection

11. Select 7-Sensor from the main menu.
12. Enter the corresponding number to enable the sensors that are installed on the sonde.
13. After all installed sensors have been enabled, press Esc to return to the main menu.

### Report Set-up

14. Select 6-Report from the main menu.
15. Select the following parameters:  
Date, Time, Temp C, SpCond mS/cm, DO %, DO chrg, Depth feet, pH, Orp mV, battery voltage.
16. Press Esc to return to the main menu.

### Sensor Calibration – pH, ORP, Conductivity

To ensure more accurate results, rinse the calibration cup with distilled water, then rinse with a small amount of the calibration solution for the sensor that you are going to calibrate. Discard the rinse solution and add fresh calibration solution.

17. Immerse the probes into the solution and rotate the calibration cup several times so that the calibration cup is screwed on but not all the way.
18. If possible, support the sonde by using a ring stand and clamp to prevent the sonde from falling over.
19. From the Main menu, select 2-Calibrate.
20. Select the first parameter you wish to calibrate and press Enter.
21. Once you have selected a parameter, some of the parameters will have a number that appears in parentheses. These are the default values and will be used during calibration if you press Enter without inputting another value. If no default value appears, you must type a numerical value and press Enter.
22. After you input the calibration value, or accept the default, press Enter. A real time display will appear on the screen. When the readings have been stable for approximately 30 seconds, press Enter to accept the calibration.
23. Press Enter to return to the Calibrate menu, and proceed to the next calibration.

**Note: If an Error message appears, begin the calibration procedure again. Be certain that the value you enter for the calibration standard is correct.**

#### **Sensor Calibration – Depth, DO %**

24. To calibrate DO, place a small amount (1/8") of water in the bottom of the calibration beaker. Make sure the calibration chamber is not tight. It must be vented to atmosphere.
25. Allow the sonde to sit for approx. 10 minutes for the air in the cal chamber to become saturated and the temperature to stabilize.
26. Select DO% from the calibration menu. Input the correct barometric pressure in mm of Hg.
27. Press Enter and the current values will be displayed. Observe the readings under DO%. When they show no significant change for approx. 30 seconds, press Enter.
28. The screen will indicate that the calibration has been accepted and prompt you to press Enter again to return to the calibration menu.
29. For the depth and level calibration, you can leave the sonde set-up the same way as for the DO probe.
30. Select Pressure-Abs from the calibration menu. Input 0.00 and press Enter.
31. Allow the readings to stabilize for 30 seconds or no significant change. Press Enter to accept the readings. Press Enter again to return to the calibration menu.
32. Calibration is now complete.

#### **Taking & Logging Readings**

1. Select 1-Run from the main menu.
2. Select 1-Discreet Sample from the Run Setup menu.

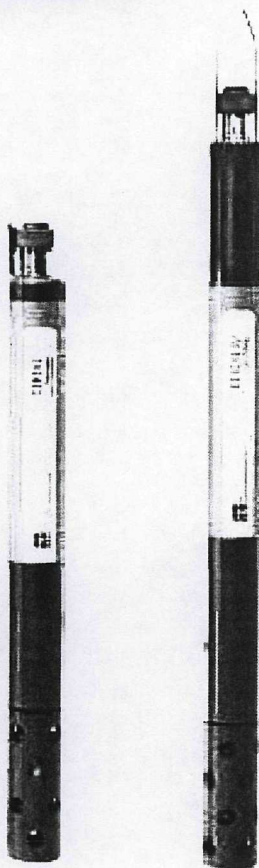
3. Select 2-Sample interval from the Discreet sample menu. Set the sample interval to 4 seconds.
4. If a file is listed, select 5-Close File. If no file is listed, go to the next step.
5. Select 3-0File from the Discreet sample menu. Enter a file name to log readings into.
6. Select 5-Open File from the Discreet sample menu.
7. Select 1-Start Sampling from the Discreet sample menu.
8. Select 2-Log ON/OFF. Data will not be stored in the file you named earlier.
9. Allow a few minutes of data to be stored. Select 2 to turn logging off.
10. Press Esc back to the main menu.
11. Select 3-File from the main menu.
12. Select 3-Quick Upload from the File menu.
13. Select 1-PC6000. You should see a box open with the file name and the data being transferred. When the transfer is completed Esc back to the main menu.

### **Viewing and Printing Data**

1. Click on the OPEN file icon. Select the file you just created.
2. Depending on how the last file was opened, you may see the data as a graph or as text.
3. From the tool bar, select the VIEW option. Select or de-select the graph or table option to your preference.
4. Print a copy of the data for QC and the customer. Please print the data as text and not a graph.
5. END OF PROCEDURE.



YSI Environmental



The YSI 600XL and 600XLM.

**Compatible with  
EcoWatch® for  
Windows® software for  
data analysis and more!**

## YSI 600XL and 600XLM Sondes

### Measure multiple parameters simultaneously

The YSI 600XL and YSI 600XLM compact sondes measure eleven parameters simultaneously:

DO (% and mg/L)	ORP
Temperature	Depth or Level
Conductivity	Total Dissolved Solids*
Specific Conductance*	Resistivity*
Salinity*	pH

### Connect with Data Collection Platform

Either sonde can easily connect to the YSI 6200 DAS (Data Acquisition System), or your own data collection platform, via SDI-12 for remote and real-time data acquisition applications.

### In addition

The YSI 600XLM is an economical logging system for long-term, *in situ* monitoring and profiling. It will log all parameters at programmable intervals and store 150,000 readings. At one-hour intervals, the instrument will log data for about 75 days utilizing its own power source. The 600XL can also be utilized in the same manner with user-supplied external power.

- Either sonde fits down 2-inch wells
- Horizontal measurements in very shallow waters
- Stirring-independent Rapid Pulse™ dissolved oxygen sensor
- Field-replaceable sensors
- Easily connects to data collection platforms such as the YSI 6200 DAS
- Available with detachable cables to measure depth up to 200'
- Compatible with YSI 650 Multiparameter Display System
- Use with the YSI 5083 flow cell for groundwater applications

\* Calculated parameters.





**To order or for more  
information, contact  
YSI Environmental.**

**800 897-4151**

**www.YSI.com**

YSI Environmental  
937 767 7241  
Fax 937 767 9353  
environmental@YSI.com

Endeco/YSI  
508 748 0366  
Fax 508 748 2543  
environmental@YSI.com

YSI Environmental  
European Support Centre  
44 1730 710 615  
Fax 44 1730 710 614  
europe@YSI.com

YSI (Hong Kong) Limited  
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Fax 852 2834 0034  
hongkong@YSI.com

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81 44 222 0009  
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nanotech@YSI.com

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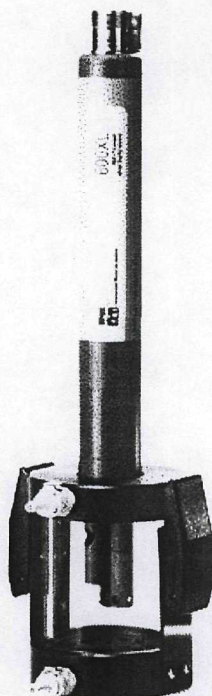
**ISO 9001  
ISO 14001**

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## 600XL & 600XLM Sensor Specifications

<b>Dissolved oxygen % saturation</b>	Range	0 to 500%
	Resolution	0.1%
	Accuracy	0 to 200%: $\pm 2\%$ air sat; 200 to 500%: $\pm 6\%$ air sat
<b>Dissolved oxygen mg/L</b>	Range	0 to 50 mg/L
	Resolution	0.01 mg/L
	Accuracy	0 to 20 mg/L: $\pm 0.2$ mg/L; 20 to 50 mg/L: $\pm 0.6$ mg/L
<b>Conductivity †</b>	Range	0 to 100 mS/cm
	Resolution	0.001 to 0.1 mS/cm (range-dependent)
	Accuracy	$\pm 0.5\%$ of reading + 0.001 mS/cm
<b>Temperature</b>	Range	-5 to +45°C
	Resolution	0.01°C
	Accuracy	$\pm 0.15^\circ\text{C}$
<b>pH, includes most low-ionic-strength measurements</b>	Range	0 to 14 units
	Resolution	0.01 unit
	Accuracy	$\pm 0.2$ unit
<b>Non-vented depth, shallow</b>	Range	0 to 30 feet (0 to 9 m)
	Resolution	0.001 foot (0.001 m)
	Accuracy	$\pm 0.06$ foot ( $\pm 0.02$ m)
<b>Non-vented depth, medium</b>	Range	0 to 200 feet (0 to 61 m)
	Resolution	0.001 foot (0.001 m)
	Accuracy	$\pm 0.4$ foot ( $\pm 0.12$ m)
<b>Vented level</b>	Range	0 to 30 feet (0 to 9 m)
	Resolution	0.001 feet (0.0003 m)
	Accuracy	0 to 10 feet (0 to 3 m): $\pm 0.01$ feet (0.003 m) 10 to 30 feet (3 to 9 m): $\pm 0.06$ feet (0.01 m)
<b>ORP</b>	Range	-999 to +999 mV
	Resolution	0.1 mV
	Accuracy	$\pm 20$ mV
<b>Salinity</b>	Range	0 to 70 ppt
	Resolution	0.01 ppt
	Accuracy	$\pm 1\%$ of reading or 0.1 ppt, whichever is greater



YSI Model 5083 flow cell and 600XL. This is an ideal combination for groundwater applications.

### YSI 600XLM sonde

**Sampling Medium:** Fresh, sea or polluted water

**Temperature:** -5 to +45°C

**Computer interface:** RS-232, SDI-12

**Logging memory:** 384K flash ROM logs ~150,000 readings

**Software:** PC-compatible, Windows® 95 or higher;  
256K RAM minimum.

Graphics card recommended.

**Size:** 1.65" dia., 21.3" long (4.32 x 54.1 cm)

**Weight with batteries:** 1.5 lbs (0.7 kg)

**External power supply:** 12 VDC

**Internal power supply:** 4 AA-alkaline cells capable  
of logging for 75 days at one-hour intervals at 25°C

### YSI 600XL sonde

**Sampling Medium:** Fresh, sea or polluted water

**Temperature:** -5 to +45°C

**Computer interface:** RS-232, SDI-12

**Software:** PC-compatible, Windows® 95  
or higher; 256K RAM minimum.

Graphics card recommended.

**Size:** 1.65" dia., 16" long, 1.3 lbs.

(4.19 x 35.6 cm, 0.49 kg)

**External power supply:** 12 VDC

† Report outputs of specific conductance (conductivity corrected to 25°C), resistivity, and total dissolved solids are also provided. These values are automatically calculated from conductivity according to algorithms found in *Standard Methods for the Examination of Water and Wastewater* (ed 1989).

**SOP FOR MARK PRODUCTS 9822 HELIUM DETECTOR  
(OR EQUIVALENT)**

**Operating Instructions**

1. Keep Auto-Zero Ports on each side of the instrument free of obstructions during operation.
2. Maximum Sensitivity is achieved after a 25-minute warm-up.

**Calibration Procedure**

1. Connect the sample probe to the right side of the unit.
2. Press the ON/OFF switch once.
3. 5 minute count down begins.
  - a. SAMPLE, READ PURGE and SURVEY LEDs will turn on for 20 seconds.
4. Three beeps sound at end of the count down.
5. CAL is displayed and SURVEY LED turns on.
6. 00 is displayed.
7. Apply Calibration Gas to the sample inlet.
  - a. The display starts increasing in value and settles near the concentration value of the gas.
  - b. Remove the calibration gas.
8. Press the BATCH/SURVEY button.
9. CAL is displayed and the PURGE LED turns on.
10. 00 is displayed.
11. Apply the CALIBRATION Gas to the sample inlet.
12. Press the RUN button.
  - a. The display increases in value.
  - b. The SAMPLE LED turns on.
  - c. The READ LED turns on when the SAMPLE LED turns off.
  - d. The display locks near the concentration value of the gas.
  - e. The PURGE LED turns on when the READ LED turns off.
  - f. The PURGE LED turns off.



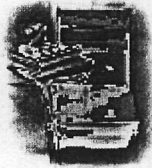


a Dielectric Pressurization Systems Company ♦ ♦ ♦ ♦

## Service & Support

[Service & Support NAV](#)[Reference Manual](#)[Trouble Shooting](#)[Warranty Info](#)

Mark Products  
Bridgton Commerce Center  
RR#2, Box 756  
Bridgton, ME 04009  
Tel: (207) 647-9495  
Toll Free: (877) 247-3797  
Fax: (207) 647-9496  
[info@marktel.com](mailto:info@marktel.com)

[Reference Manual](#)

### Battery Replacement Procedures

*For Mark Products Helium Detectors*

#### Mark Models 1820A

1. Remove the four Phillips screws from the top; then remove the cover, straight up.
2. Remove the two small nut & bolts in the rear that's holding the battery bracket. Then remove the rear plate straight up.
3. Remove the battery connectors with long nose pliers; gingerly lay the resistor/connector unit forward (tip) and with a firm grasp, pull the battery straight up (it's on double stick tape).
4. Replace battery; making sure there are no kinks in the tubing or wires, and that the positive and negative wires are in the same position as when removed. Positive (orange) to the right facing the set.
5. Replace the negative connector first, then completely seat the resistor/connector unit and connect the positive lead.
6. Rebolt the back plate to the unit.
7. Replace the top straight down.
8. Replace the four Phillips screws snugly.
9. Recharge your set (overnight) to make sure your battery is at full charge.
10. Your set is ready for use.

#### Mark Model 9822

1. Remove the four Phillips screws from the top; then remove the cover, straight up.
2. Lift the battery holder/rear plate straight up and remove.
3. Un-plug battery using long nose pliers making sure to watch the positive and negative anodes (positive is to the right facing the set and is orange).
4. Then with a firm grip, pull straight up (it's on double stick tape).
5. Replace the battery - positive side right, pushing down firmly.
6. Replace battery holder/rear plate assembly, pushing straight down, making sure no wires or hoses are kinked.
7. Replace cover and tighten the four Phillips screws down snugly.
8. Recharge your set (overnight) to make sure your battery is at full charge.
9. Your set is ready for use.

**Battery for all models: Tempest Power Security Battery TR 1.9-12**

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## **SOP FOR RKI INSTRUMENTS EAGLE™ MULTI-GAS DETECTOR (OR EQUIVALENT)**

### **Purpose**

The RKI Eagle™ Portable Multi-Gas Detector will be used to detect carbon dioxide (CO<sub>2</sub>), oxygen (OXY), and methane (CH<sub>4</sub>) concentrations in vapor samples. This SOP summarizes procedures for the unit including operation and calibration.

### **Start Up**

1. Connect sample hose to inlet fitting.
2. Connect hydrophobic filter and probe tip to sample hose fitting.
3. Press and briefly hold down the POWER/ENTER button.
4. The Battery Voltage screen displays the minimum usable and actual battery voltage. If the battery voltage is too low, the instrument will not continue.
5. The instrument will then perform a self diagnosis and alert the user if a malfunction occurs. Upon successful completion of the self check, an "OK" message is displayed and the normal operating screen displays. The operating screen should display CH<sub>4</sub> (LEL%), OXY (VOL %), and CO<sub>2</sub> (ppm).

### **Normal Operation**

The instrument continuously monitors the sampled vapor and displays the concentrations of the target gases. In a low light environment, press any button to turn on the display backlight.

### **Monitoring Combustible Gas (Methane) in the PPM Range**

1. After startup, allow the combustibles sensor to stabilize (3 to 5 minutes). This stabilization period is required for ppm range operation.
2. Press the LEL/PPM button. The instrument will display PPM in place of LEL% for combustible gas.
3. If the PPM reading is not zero, take the instrument to a fresh air environment, then perform the demand zero procedure.
4. If the unit is calibrated to methane, the reading represents the methane concentration.

### **Monitoring CO<sub>2</sub>**

CO<sub>2</sub> is a background gas in fresh air. The unit will be equipped with a sensor having a detection range of 0 to 10,000 ppm. The approximate fresh air reading should be 400 ppm.

A CO<sub>2</sub> scrubber is mounted to the exterior front of the instrument. The scrubber is for use when setting the sensors zero reading only. Replace the scrubber if it turns from white to a violet color.

### **Setting Demand Zero**

1. Connect the CO<sub>2</sub> scrubber directly to the units inlet fitting.
2. Wait one minute for the fresh air sample to flow through the CO<sub>2</sub> scrubber, then press the AIR/▲ button to set the zero reading. If the CO<sub>2</sub> sensor fails when you press the button, use the zero control (marked F.ZERO) on the amplifier to adjust the reading to zero. DO NOT ADJUST THE C.ZERO CONTROL.
3. Remove the tubing from the CO<sub>2</sub> scrubber and probe.

### **Calibration**

Calibrate the instrument periodically to assure proper sensor response. A typical calibration frequency is once per month.

### **Calibration Supplies and Equipment**

- Four-Gas Cylinder
- Demand Flow Regulator

### **Procedure**

1. Take the instrument to a non-hazardous location with fresh air conditions.
2. Turn on the instrument and allow at least one minute for warm up.
3. Press and hold the AIR/▲ button until a tone sounds. The unit will automatically set the combustible gas and toxic gas to zero. Oxygen will be set to 20.9%.
4. Connect the regulator to the calibration cylinder.
5. Connect the calibration tubing to the regulator.
6. Press and hold the SHIFT/▼ button, then press the DISP/ADJ button. The calibration menu displays.

7. The menu includes two methods of calibration – auto calibration and single calibration. The Auto Calibration Method is described as follows.
8. Use the AIR/▲ and SHIFT/▼ button to place the prompt next to the AUTO CALIBRATION menu option.
9. Press the POWER/ENTER button to display the Calibration Values screen.

C	CH4	50	LEL%
A	OXY	12.0	VOL%
L	H2S	25.0	PPM
.	CO	50	PPM

The gas concentrations displayed in the Calibration Values screen must match the gas concentrations listed on the Four-Gas Calibration Cylinder. If *all* concentrations match, go to Step 7. If *one or more* concentrations do not match, continue with step 3.

10. To adjust the values on the screen, hold down the SHIFT/▼ button, and press the DISP/ADJ button. The Auto Calibration screen for the combustible gas channel displays.

AUTO CALIBRATION
<CH4>
50 LEL%

11. Use the AIR/▲ (increase) and SHIFT/▼ (decrease) buttons to set the correct combustible gas value.
12. Press the POWER/ENTER button to enter the new setting. The Auto Calibration screen for the next channel displays.
13. Repeat steps 4 and 5 to set the correct values for the remaining channels and return to the Calibration Values screen.

**NOTE:** The Four Gas Cylinder contains approximately 12% O<sub>2</sub> by volume. Be sure to set the "OXY" reading to agree with the concentration listed on the cylinder's label, not zero.

14. With the Calibration Values screen displayed, press the POWER/ENTER button. The gas readings flash.
15. Connect the tubing from the regulator to the probe. Wait approximately 1 minute or until the readings stabilize.
16. Press the POWER/ENTER button to set the calibration to the programmed values.

If a sensor(s) cannot calibrate to the proper value **FAIL PUSH AIR KEY** displays and

the instrument lists the sensor(s) that failed to calibrate. (The other sensors calibrate normally.) The buzzer and alarm lights activate. Press the AIR/▼ button to reset the alarm and return to the Calibration menu. Replace the failed sensor(s), then repeat calibration.

17. **AUTO CALIBRATION END** displays, then the Calibration menu displays.
18. Disconnect the tubing from the probe.
19. Unscrew the regulator from the calibration cylinder.
20. Press the SHIFT/▼ button to place the prompt next to the **NORMAL OPERATION** menu option, then press the POWER/ENTER button to return to the normal screen.

**Instruction Manual for Rkl Instruments Eagle <sup>TM</sup> Multi-Gas Detector to be provided to field personnel.**

**SOP FOR DWYER THERMAL ANEMOMETER  
(OR EQUIVALENT)**

**Purpose**

A Thermal Anemometer is a hand-held, battery operated instrument for easily and accurately measuring both air velocity and temperature. The device is equipped with a permanently attached telescoping probe requiring a 7/16 " hole for insertion. For optimum accuracy, the tip must be extended at least 2 ½" and the two openings in the tip must be parallel to air flow. To assure proper alignment, note the orientation of the openings relative to the handle before insertion.

**Operation**

1. Press the ON/OFF key once to turn unit on. The unit will display velocity or temperature.
2. If a backlight display is needed first, turn the unit off, then press and hold the ON/OFF key down. After approximately 1 second, the backlight will switch on and remain lighted for approximately 2 minutes.
3. To switch between velocity and temperature, press the VELOCITY/TEMP key.
4. To change units, press the UNITS key.
5. To select a velocity range, press the range key until the desired range is shown in the lower left corner of the display. The unit will temporarily read zero until the sensor stabilizes.
6. If the LO BAT Indicator is displayed, replace the battery with a fresh 9-volt alkaline type such as Duracell® MN1604, Eveready® 522 or equivalent. Zinc carbon types are not recommended.

**Care and Cleaning**

1. Always cover the tip when not in use by fully collapsing the telescoping section.
2. Tip is fragile and must not be touched. Do not use brushes, cotton swabs, etc. to clean.
3. To clean, gently bathe the probe tip in a small container of denatured alcohol. Wash briefly and avoid extended soaking. Remove and gently shake off excess.



## MODEL 471-2 DIGITAL THERMO ANEMOMETER

### Physical Data – Operating and Cleaning Instructions



#### Introduction

The Dwyer Model 471-2 Thermo Anemometer is a hand-held battery operated instrument for easily and accurately measuring both air velocity and temperature. Four velocity ranges are selectable, reading in your choice of FPM (feet per minute) or MPS (meters per second). For temperature, units will indicate in °F or °C. The 471-2 includes a permanently attached telescoping probe which extends to 33 inches (83 cm). A 7/16" (11.1 mm) hole is required for full insertion. For optimum accuracy, be sure to extend the tip a minimum of 2 1/2" (6.36 cm) for all measurements. When extending or collapsing the tip, be sure the connecting cable moves freely through the opening at the base of the handle. Also note that the two openings in the tip must be parallel to air flow for best accuracy. A convenient way to assure proper alignment when tip is out of view—such as inside a duct—is to note the orientation relative to the handle before insertion.

#### Battery Installation

To install the 9 volt alkaline battery, first remove the two screws and end cap at the bottom of unit. Attach the battery clip to the battery and place it inside the case. Be careful not to pinch wires when putting battery in place. Replace cover and sealing gasket. If wrist strap will be used, install "Z" shaped clip under one of the screw heads before securing. Do not overtighten screws. Snap wrist strap to the clip.

#### On-Off Operation

The on-off control is a toggle function. Press the ON/OFF key once to turn unit on and again to turn it off. If the Model 471-2 is left on for approximately 2 1/2 minutes with no activity, the device will turn off automatically to conserve battery life.

#### Display Backlight

The Model 471-2 includes a standard backlight display to improve visibility under poor lighting conditions. The instrument must first be switched off before this feature can be activated. Next, press and hold the ON/OFF key down. After about 1 second, the backlight will switch on and remain lighted for approximately 2 minutes. It will then automatically shut off to conserve battery life.

#### Selecting Velocity or Temperature Measurement

To switch between velocity and temperature measurement, press the VELOCITY/TEMP key.

#### PHYSICAL DATA

##### Temperature Measurement

Ranges: 0 to 200°F (-17 to 100°C)

Temperature Accuracy: ±2°F, 1°C

Resolution: 0.1°

Ambient Temperature Limits: 32 to 140°F (0 to 40°C)

Storage Temperature Limits: -40 to 176°F (-40 to 80°C)

Power Source: 9 volt alkaline battery

Probe: 7/16" dia. (11.1 mm), length adjustable to 33" (83 cm)

##### Air Velocity Measurement

Flow Temperature Range: 32 to 200°F (0-100°C)

Range No.	Velocity, FPM	Velocity, MPS	Accuracy*
1	0-500	0-3.0	±3% F.S.
2	0-1500	0-7.0	±3% F.S.
3	0-5000	0-30	±4% F.S.
4	0-15000	0-70	±5% F.S.

\*Temperature limits for velocity accuracy specified are 59 to 86°F (15 to 30°C). Outside these ranges add 0.11% per °F (0.2% per °C).

#### Selecting Units of Measurement

The Model 471-1 will display velocity or temperature in either English or metric units. Velocity can be expressed in your choice of feet per minute (FPM) or meters per second (MPS). Temperature can be indicated in either °F or °C. Currently selected units will be indicated on the display. To change units press the UNITS key. Units selected will remain in memory even when power is shut off.

#### Selecting Velocity Range

Four velocity ranges can be selected in either English or metric units. Choose a range where typical readings fall within the center to upper portion of the span. The range selected will be shown in smaller characters in the lower left corner of the display. To change ranges, press the RANGE key until the required one is shown. Each time the range is changed, the displayed velocity will momentarily read zero until the sensor stabilizes with the new range.

#### Low Battery Indicator

A weak battery can cause improper operation and/or inaccurate measurements. A low battery indicator is included on the display to warn when the battery needs to be replaced. Although the unit might appear to operate and indicate properly, accuracy of readings cannot be assured when the LO BAT indicator is displayed. Replace the exhausted battery with a fresh alkaline type such as Duracell® MN1604, Eveready® 522 or equivalent. Zinc carbon types are not recommended because of their significantly shorter life and increased potential for leakage. Do not leave exhausted batteries in the unit due to possible leakage and resulting damage.

#### Probe Care and Cleaning

Always cover the tip when not in use by fully collapsing the telescoping sections. Use only in clean, dry particulate free air. Although probe requires little maintenance, occasional cleaning may be necessary for best accuracy. **Caution:** Tip is fragile and must not be touched. **Do not** use brushes, cotton swabs, etc. to clean. Remove battery before cleaning. Provide adequate ventilation and gently bathe the probe tip in a small container of denatured alcohol. Wash briefly, avoiding extended soaking. Remove from bath and gently shake off excess. Allow to completely air dry before replacing battery and returning to service. **Do not** use pressurized cleaners or compressed air, both of which could cause permanent damage.

**SOP FOR SKC DUAL BALL/FIELD ROTOMETERS  
(OR EQUIVALENT)**

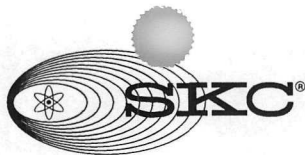
**Operation**

1. Operator rotometer in a vertical position to assure accuracy.
2. Connect the tubing from the monitoring well to the top of the rotometer.
3. If using a dual ball (dual range) rotometer, read the black ball on the rotometer until it goes off-scale, then begin reading the silver ball. Note that each ball has a separate scale.
4. If using a single range (field) rotometer, read the black glass or stainless steel ball.

**Maintenance**

Occasionally clean the rotometer if dirt appears in it or if float movement is restricted.

1. Remove the top plug, float stop, and ball float.
2. Wash the tapered hole, ball float, float stop, and top plug with a mild liquid detergent and a soft brush. Rinse all parts with clean water and dry thoroughly. Avoid using solvents.
3. Reinstall the ball float, float stop, and top plug. Use a small amount of (halocarbon grease or other compatible O-Ring lubricant to ease installation of the top plug.



## Operating Instructions

863 Valley View Road, Eighty Four PA 15330 USA

Tel: 724-941-9701 e-mail: skctech@skcinc.com

### Precision Dual Ball Rotameters 320 Series

These rotameter-style dual-ball flowmeters are designed specifically for the field calibration of air sample pumps. SKC rotameters are secondary standards and should be calibrated by the user with a primary standard calibrator at regular intervals. Since rotameters are affected by temperature and atmospheric pressure, rotameter calibration should be performed under the conditions of use or a mathematical correction should be used.

**Model 320-235-4600 (high flow)** has a dual range. Read the scale on the glass tube itself for the black (top) ball for a flow range of 225 to 2350 ml. Read the black and white scale at left for the silver (bottom) ball for a flow range of 500 to 5000 ml.

**Model 320-5-245 (low flow)** has a dual range. Read the scale on the glass tube itself for the black (top) ball for a flow range of 4 to 49 ml. Read the black and white scale at left for the silver (bottom) ball for a flow range of 24.5 to 245 ml. **Note:** Low flow rotameters can only be used with pulsation-free pumps.

**Model 320-5-4600 (low and high flow)** contains two dual ranges.

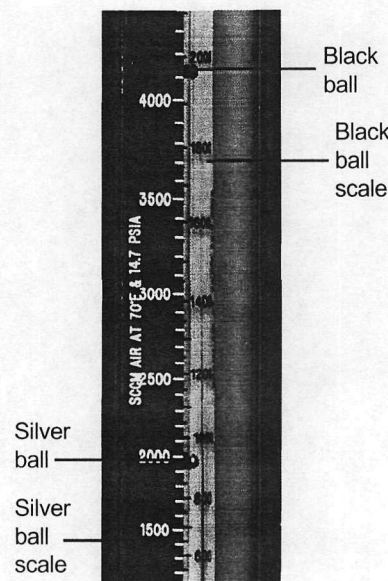
**On the left side:** Read the scale on the glass tube itself for the black (top) ball for a flow range of 4 to 49 ml. Read the black and white scale at left for the silver (bottom) ball for a flow range of 24.5 to 245 ml. **Note:** Low flow rotameters can only be used with pulsation-free pumps.

**On the right side:** Read the scale on the glass tube itself for the black (top) ball. This range is 225 to 2350 ml. Read the black and white scale at left for the silver (bottom) ball for a flow range of 500 to 5000 ml.

#### Operation

1. Using tubing, attach the top fitting (outlet) of the rotameter to the inlet of the sample medium.
2. Using another piece of tubing, attach the outlet of the sample medium to the inlet of the sample pump. The sample medium is now in-line between the rotameter and the pump.
3. Turn the pump on.
4. Read the black ball on the rotameter until it goes off scale, then begin reading the silver ball.

**Note:** Model 320-5-4600 contains two dual scales. When the black and silver balls have both gone off scale on the left side, begin reading the flow on the black ball, then the silver ball on the right side.



pump. The sample medium is now in-

#### Warning

Do not attempt to service this device.

Do not exceed 200 PSIG at 200 F. Operations at conditions beyond this point may cause rupture of the flowmeter and serious personal injury.

www.skcinc.com

Form #3750—Rev 0212

## Congratulations on your purchase of a quality SKC Calibrator —

In today's working environment, Occupational Health and Safety Management Systems include annual maintenance and calibration of all testing equipment. SKC offers you a recalibration service designed to verify that your calibrator is traceable to a primary standard.

#### Here's how SKC's Recalibration Service works:

- Call our Customer Service Team, 800-752-8475, to purchase this calibration service. Provide a purchase order number and Customer Service will furnish you with a return authorization number and other necessary information.
- Package glass items carefully, mark package "Fragile," and ship your calibrator to SKC Inc.
- Upon arrival, your calibrator will be recalibrated to a primary standard that is traceable to a NIST standard.
- A label will be placed on each calibrator to document the date of calibration and you will also receive a Certificate of Calibration for each calibrator.

#### The Benefits of Recalibration

- Accurate measurements of flow rates
- Adherence to Occupational Health and Safety Management Systems or company quality programs
- Documentation of traceability to a primary standard

**Note:** The frequency of recalibration is a function of use. The user is responsible to ensure calibration is maintained.



#### Shaping the future of air sampling

SKC Inc. • 863 Valley View Rd. • Eighty Four, PA 15330 USA

Phone: 724-941-9701 • Fax: 724-941-1369

www.skcinc.com

*Notice: This operating instruction may not address all safety concerns (if any) associated with this product and its use. The user is responsible for determining and following the appropriate safety and health practices and regulatory limitations (if any) before using the product. The information contained in this document should not be construed as legal advice, opinion, or as a final authority on legal or regulatory procedures.*



## Maintenance

Occasionally clean the rotameter if dirt appears in it or if float movement is restricted. To clean:

1. Remove the top plug, float stop, and ball float.
2. Wash the tapered hole, ball float, float stop, and top plug with a mild liquid detergent and a soft brush. Rinse all parts with clean water and dry thoroughly. Avoid using solvents.
3. Reinstall the ball float, float stop, and top plug. Use a small amount of halocarbon grease or any other compatible O-ring lubricant to ease installation of the top plug and prolong O-ring life.

## Specifications

Meas. Range (L/min)	Scale (inch)	Accuracy* ±	Subdivisions (L/min)	Cat. No.
0.05-0.5	2	5%	0.05	320-2A05
0.1-1.0	4	3%	20	320-4A1
0.4-5.0	4	3%	0.2	320-4A5
4-20	4	3%	0.5	320-4A20L
4-50	4	3%	1.0	320-440
5-30	4	3%	1.0	320-530**
3-30	4	3%		320-100†

\* Full Scale

\*\* Fittings adapted for use with HV30 Sample Pump

† Fittings adapted for use with QuickTake Sample Pumps

<b>Float:</b>	Black glass or stainless steel ball
<b>Body:</b>	Clear acrylic
<b>Seals:</b>	Buna N O-ring
<b>Pressure:</b>	100 psig maximum
<b>Temperature:</b>	150 F (65 C) maximum
<b>Fittings:</b>	Brass with hose connector, Tygon® tubing, and Luer taper adapter

Form #37505—Rev 0212

## Operating Instructions



863 Valley View Road, Eighty Four PA 15330 USA

Tel: 724-941-9701 Fax: 724-941-1369 e-mail: skctech@skcinc.com

## Field Rotameters

This rotameter is packed to protect against damage during shipment. If damage occurs, notify the carrier immediately. Also, check that you have received the correct model and flow range required for your application.

### Calibration

SKC rotameters are secondary standards and should be calibrated by the user with a primary standard calibrator at regular intervals. Since rotameters are affected by temperature and atmospheric pressure, rotameter calibration should be performed under the conditions of use or a mathematical correction should be used.

### Operation

Operate the rotameter in a vertical position to assure accuracy. Use it in a manner that minimizes vibration and flow pulsation; both conditions may affect the rotameter.

Flow rate is indicated by the point on the printed scale at which the center of the ball float comes to rest. The field rotameter inlet must always be at atmospheric pressure (i.e., exposed to the atmosphere). The rotameter is the last device connected to the sampling train. Connect the inlet of the sampling pump to the outlet of the sampling medium. Connect the inlet of the sampling medium to the outlet of the rotameter.

### CAUTION

This rotameter is designed for use with non-hazardous gases at pressures up to 100 psig and temperatures up to 65 C (150 F). Do not use hazardous gases or liquids and do not exceed temperature or pressure limits. Use with hazardous fluids or beyond pressure and temperature limits may cause failure, which could result in personal injury.

**SOP FOR FOXBORO TVA 1000 FID/PID  
(OR EQUIVALENT)**

**Purpose**

To provide a maintenance and calibration procedure for the Foxboro TVA 1000.

**Materials and equipment required**

Zero Grade Air (R-SGZA)

Isobutylene Calibration Gas, 1000 PPM (R-SGISO-1000)

Methane span gas, 1000 PPM (R-SGCH-1000)

3 Tedlar bags (R-5L)

Tygon tubing (R-TYC)

**Procedure**

1. Attach the handwand assembly to the unit. Also attach the sampling probe to the handwand assembly.
2. Ensure the hydrogen tank is full and insert into the unit.
3. Power on the unit. The unit will go through a power on self test.
4. Turn the hydrogen supply valve on.
5. Press the CONTROL button. Select the number 1 option to turn on the pump.
6. Let the unit warm up for 5 minutes.
7. Again press the CONTROL button, this time select option number 2, ignite flame. The pump will momentarily stop as the flame lights.
8. Press the number 1 key to select the Run Menu from the Main Menu. The display will show the units readings. This step also lets you know if the flame lit.
9. Let the unit warm up for another 20 minutes.
10. Press the EXIT key to return to the Main Menu. Select option 2, Setup. Next select option 5, other. Next select option 4, User Options. Next select option 3, Calibration Mode. Ensure the Calibration Mode is set to Automatic.
11. Press the EXIT key three times to return to the Setup menu.
12. From the Setup Menu select the calibration option, number 1, you are now in the Calibration Menu. First select option number 5, Response Factor, ensure both the PID and FID are both set to one. If not select option 1, Both, and enter 100 through the keypad and then press the ENTER key to accept the change.
13. From the Calibration Menu select option 4 Gas Concentration next. Select option number 2, PID. Enter the span value of your PID calibration gas, ensure this value matches your Isobutylene calibration span gas. Press the ENTER key to accept your value. The unit will return to the Calibration Menu.

14. Again select the Gas Concentration option number 4. This time select option 3, FID. Enter the span value of your FID calibration gas, ensure this value matches your Methane calibration span gas. Press the ENTER key to accept your value. The unit will return to the Calibration Menu.
15. Next select option number 1, Zero. Next select option number 1, Both. Fill a Tedlar bag with Zero Grade Air and attach to the instrument. Let the gas flow for 2 minutes. Press the ENTER key to start zeroing the instrument. After the unit has zeroed itself it will return to the Calibration Menu.
16. Now select option 3, Span. Select option 2, PID. This time fill a different Tedlar bag with Isobutylene Calibration Gas. Let the gas flow for 2 minutes. Press the ENTER key to start the calibration. After the unit has set it's span value it will return to the Calibration Menu.
17. Select option 3, Span, again. Select option 3, FID. Fill a Tedlar bag with Methane Calibration Gas. Let the gas flow for 2 minutes. Press the ENTER key to start the calibration. After the unit has set it's span value it will return to the Calibration Menu.
18. Press the EXIT key twice to return to the Main Menu. Select option number 1, Run. Ensure the unit reads below 5 ppm on both the PID and FID background readings. Apply the respective calibration gasses and ensure the units reads them with +/- 1% of the calibration gas value.
19. **END OF PROCEDURE.**

**Instruction Manual for Foxboro TVA 1000 FID/PID to be provided to field personnel.**

**SOP FOR SOIL VAPOR SAMPLE COLLECTION**

The following procedure was developed as a method of collecting soil vapor samples that are representative of extracted soil gas. The procedure will consist of a vapor sample collection, field data measurements, and sample shipment.

**Vapor Sample Collection**

Soil vapor samples will be collected using the integrated bag sampling procedure presented in USEPA Method 18, "Measurement of Gaseous Organic Compound Emissions by Gas Chromatography". The procedure will be completed as follows:

1. Connect the vacuum outlet of a rigid leak-proof container or "vacuum box" to the pump.
2. Label four Tedlar bags with the appropriate sample designation, date, and time.
3. Using Teflon tubing, connect a 1-liter Tedlar bag to the sample inlet in the interior of the vacuum box.
4. Using a second piece of Teflon tubing, connect the sample inlet connection on the outside of the vacuum box to the sample port on the vapor extraction line (sample source location).
5. Close the vacuum box, making sure the Tedlar bag is not pinched when shutting the case.
6. To collect a vapor sample, turn on the pump. The pump will evacuate the vacuum box, causing the Tedlar bag inside the box to fill with sample.
7. Viewing the bag inside the box through the window provided, shut off the pump when the Tedlar bag is approximately 80% full.
8. Disconnect the sample line from the Tedlar bag and confirm that the check valve on the bag is closed.
9. Repeat the above process three times resulting in a total of four Tedlar bag samples during the sampling event. Note: Additional Tedlar bags may be added if additional sample is needed for field measurements.
10. Protect each Tedlar bag from sunlight.
11. Place three of the four Tedlar bags inside the sample shipping container after confirming that each sample is appropriately labeled. Samples must be shipped to the laboratory via overnight courier each day. No ice or refrigeration of the samples is required.
12. Discard the piece of Teflon tubing connected to the sample inlet used to collect the four bag samples. Use a new piece of Teflon tubing for each subsequent sampling event.

Note that the vapor sample never passes through the pump, eliminating the possibility of pump contamination or sample contamination during future sampling events.

### **Field Data Measurements**

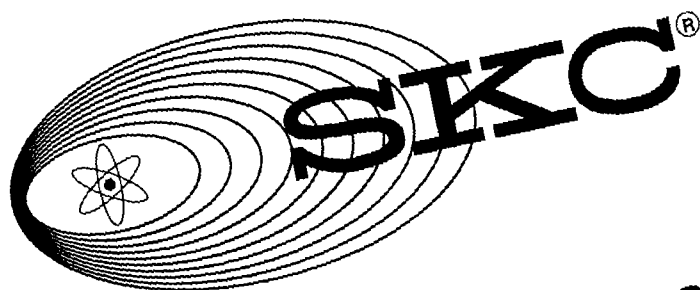
Field measurements of carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), oxygen (O<sub>2</sub>), and organic vapor concentration will be collected during each sampling event. CO<sub>2</sub>, CH<sub>4</sub>, and O<sub>2</sub> measurements will be made with a RKI Eagle gas monitor (or equivalent). Organic vapor concentrations will be measured with Foxboro TVA 1000 Flame Ionization Detector (FID)/Photoionization Detector (PID), or equivalent. Helium concentrations will be measured during AS pilot testing using a Mark Products 9822 Helium Detector. Each of the above instruments is equipped with a vacuum pump for drawing in a sample.

1. Confirm that each field instrument has been calibrated per manufacturer's instructions. Note calibration in the field logbook.
2. Opening the check valve on the Tedlar bag, connect the bag to the RKI Eagle monitor using the probe tip or Teflon tubing. Record the measured CO<sub>2</sub>, CH<sub>4</sub>, and oxygen concentration. Disconnect the Tedlar bag and close the check valve.
3. Opening the check valve on the Tedlar bag, connect the bag to the FID/PID using the probe tip or Teflon tubing. Record the PID and FID readings. Disconnect the Tedlar bag and close the check valve.
4. If measuring helium concentration, open the check valve on the Tedlar bag and connect the bag to the Helium Detector using the probe tip or Teflon tubing. Record the helium concentration. Disconnect the Tedlar bag and close the check valve.
5. Re-calibrate one or more of the above instruments per manufacturer's instructions if there is reason to question data obtained. Note calibrations in the field logbook.

### **Sample Shipment**

Vapor samples will be shipped to the laboratory as follows:

1. Vapor samples will be placed in the sample shipment container without ice.
2. If necessary, packing material will be used to prevent bags from puncturing during shipment.
3. Chain of custody forms will be placed in each sample shipment container.
4. The sample shipment container will be properly closed and sealed with packaging tape.
5. Sample shipping containers will either be hand delivered to the laboratory by field personnel or transferred to an appropriate shipping service for overnight delivery.



**Operating Instructions**  
**Universal Sample Pump**  
**Catalog No. 224-44XR**

**SKC Inc.**  
**863 Valley View Road**  
**Eighty Four, PA 15330**

Form #37711 Rev 9912

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## Description

The result of extensive research and development, the 44XR is a constant flow air sampler suited for a broad range of applications. It is ideal for industrial hygiene studies as well as environmental testing.

**Durable RFI-Shielded Case**  
provides protection from radio frequency interference between 27 and 1000 MHz.

**Rechargeable NiCad Battery**  
provides continuous 8-hour operation on a single charge.

**External Exhaust Port**  
for bag sampling.

**Low Flow Regulator**  
allows pump to be switched from high to low.

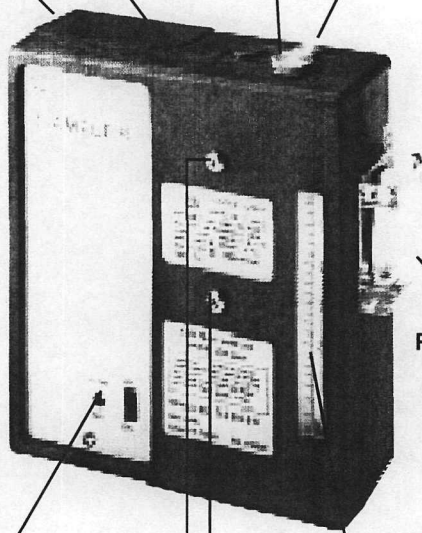
**Anti-tamper Cover**  
prevents inadvertent changes to settings.

**Recessed Flow Adjustment**  
adjust flow rate between 750 and 5000 ml/min.

**Accessory Mounting Screws**  
allow sampling accessories such as impinger holders to be secured to pump..

**Built-in Particulate Trap**  
in see-through housing protects pump.

**Built-in Rotameter**  
provides a visible check of relative flow rate during sampling, from 0.5 to 5 LPM..





## Specifications

<b>Operating Range:</b>	5-5000 ml/min (5-500 ml/min requires adjustable low flow holder)
<b>Weight:</b>	33 oz (936 gm)
<b>Dimensions:</b>	1-15/16 x 4-11/16 x 5-1/8 inches, 46.5 cubic inches (4.9 x 11.9 x 13 cm, 758 cubic cm)
<b>Compensation Range</b>	750 to 2500 ml/min—to 40 inches water back pressure 3000 ml/min—to 35 inches water back pressure 4000 ml/min—to 20 inches water back pressure
<b>Flow Control:</b>	±5% Set Point Constant Flow
<b>Run Time:</b>	8 hrs min at 4000 ml/min & 20 in water back pressure
<b>Flow Indicator:</b>	Built-in flow indicator with 250 ml division; scale marked at 1, 2, 3, 4, & 5 LPM
<b>Battery Assembly:</b>	Plug in battery pack, rechargeable NiCad 2.0 Ah, 6.0 V UL Listed.
<b>Intrinsically Safe:</b>	UL Listed for: Class I, Groups A, B, C, D; Class II, Groups E, F, G; and Class III. Temp Code T3C.
<b>Operating Temp:</b>	-20 C to +45 C (-4 F to +113 F)
<b>Storage Temp:</b>	-40 C to +45 C (-40 F to +113 F)
<b>Charging Temp:</b>	+5 C to +45 C (+41 F to +113 F)
<b>Operating Humidity:</b>	0 to 95% Relative
<b>Multiple Sampling:</b>	Built-in constant pressure regulator allows user to take up to four simultaneous samples at different flow rates up to 500 ml/min (total combined flow 1350 ml/min maximum) using optional low flow control.
<b>RFI/EMI Shielding Performance:</b>	Complies with requirements of EN 55022, FCC Part 15 Class B, EN 50082-1, Frequency range of the radiated susceptibility test was 27 MHz to 1000 MHz. CE approved.

# Operation

## High Flow Applications (750-5000 ml/min)

### Setup

Fully charge the battery by connecting the charger plug to the sampler charging jack (Figure 1, #15). Use only an SKC charger designated for this model. **CAUTION! DO NOT CHARGE IN A HAZARDOUS ENVIRONMENT.** Using 1/4 inch Tygon tubing, connect the sampling media to the pump intake (Figure 1, #6). Make sure the pump is set for High Flow. (See "Return to High Flow" p. 4).

### Setting the Flow Rate

Connect a flowmeter to the intake of the sampling media. Start the pump using the ON/OFF switch (Figure 1, #1), and set the flow rate using the FLOW ADJUST SCREW (Figure 1, #4). When the flow rate is set, turn the pump "off" and disconnect the flowmeter. Replace the sampling media used for calibration with new media for sample collection.

**Caution!** When using impingers, place an in-line trap between the pump and the impinger to protect the sampler from liquid or vapors. **FAILURE TO USE THE IMPINGER TRAP VOIDS THE WARRANTY.** The impinger and trap may be mounted to the sampler using the accessory mounting screws (Figure 1, #5).

### Sampling

For personal sampling, clip the sample collection media to the worker in the breathing zone. Start the sampling period by turning the pump "on", and record the start time. At the end of the shift, turn the pump "off" and record the stop time.

## Low Flow Applications (5-500 ml/min)

### Setup

Fully charge the battery by connecting the charger plug to the sampler charging jack (Figure 1, #15). Use only an SKC charger designated for this model. **CAUTION! DO NOT CHARGE IN A HAZARDOUS ENVIRONMENT.**

Start the pump using the ON/OFF switch (Figure 1, #1) and adjust the flow rate to approximately 1.5 LPM (Figure 1, #4 and #10). If performing multiple sampling using an adjustable flow tube holder (dual, tri, or quad), the flow rate of the pump must be greater than the sum of the flow rates through the tubes; the flow rate through any one tube cannot exceed 500 ml/min.

Remove the screw cap (Figure 1, #11) covering the regulator isolation valve. Turn the exposed screw 4-5 turns counterclockwise. Replace the screw cap. The pump is now set for low flow. Connect an adjustable low flow holder (Figure 2) to the pump intake

### **Setting the Flow Rate**

Connect a flowmeter to the exposed end of the sorbent tube. Loosen the phillips head screw on the low flow holder, and rotate the anti-tamper cover (Figure 2, #1) to expose the brass screw(s) (Figure 2, #2). Adjust the flow rate by turning the brass screw until the flowmeter indicates the desired flow. Do not adjust the flow on the pump. Adjust the flow only by using the brass screw (Figure 2, #2) on the low flow holder.

When the flow rate is set, turn the pump "off", and disconnect the flowmeter. Replace the sorbent tube used for setting the flow with a new sorbent tube for sample collection. Place the appropriate size tube cover (Figure 2, #5) over the tube, and screw it in place on the low flow holder.

### **Sampling**

Clip the low flow holder to the worker in the breathing zone. Start the sampling period by turning the pump "on" (Figure 1, #1), and record the start time. At the completion of the test, turn the pump "off" and record the stop time.

### **Return to High Flow**

To return to High Flow, remove the screw cap (Figure 1, # 11) covering the regulator isolation valve. Turn the exposed screw clockwise until it stops. (Do not over-tighten.) Replace the screw cap. The pump is now set for high flow.

### **Bag Sampling by Positive Pressure**

Using 1/4 inch Tygon tubing, connect the sampling media to the pump intake (Figure 1, #6). (For sample bags using positive pressure filling, insert the exhaust fitting into the exhaust port, Figure 1, #12. After setting the flow rate, you will connect the sample bag to this fitting instead.)

# Preventative Maintenance

## Battery Pack Maintenance

**Removal**—Remove the two screws (Figure 1, #13) which secure the battery pack (Figure 1, #14) and loosen the four case screws above and below the belt clip. Carefully slide the battery pack out from under the belt clip (Figure 1, #16) being careful to keep it straight.

**Replacement**—Slip the front edge of the battery pack (Figure 1, #14) under the belt clip (Figure 1, #16) and rotate the battery pack so the rails engage the slots on the case front. Push the battery pack until it is properly located. Reinstall battery screws (Figure 1, #13) and tighten the case screws.

## Charge Maintenance

For proper maintenance of battery packs, SKC produces an optional cycling charger (Catalog No. 223-426) which discharges and recharges the battery automatically to protect against memory effects.

Rotate the use of any spare pack to avoid idle periods in excess of one month. Fully charge packs before or after use or storage.

SKC UL Listed Battery Packs (SKC Catalog No. P21661) contain a protective device to eliminate potential short circuiting while the pump is in use. If the battery pack becomes defective, the indicator light on the battery charger will not light while charging. Otherwise the charger or the wall outlet is inoperative. Process of elimination should indicate which unit is defective. If you are unable to determine which is defective, please contact SKC's Customer Service Department (724-941-9701) for further assistance.

**Caution: Do not charge in a hazardous environment.**

**Warning: Using a non-approved charger voids the SKC warranty.**

**Warning: Tampering with the battery pack voids the SKC warranty and the UL Intrinsic Safety listing.**

### **Pump Inlet Filter**

The SKC Sampler is fitted with a filter/trap inside the clear plastic intake port housing. This prevents particulates from being drawn into the pump mechanism. Occasionally, the filter should be visually checked to assure that it does not become clogged. If maintenance is necessary:

1. Clean all dust and debris from around the filter housing.
2. Remove the four screws (Figure 1, #7) and the front filter housing.
3. Remove and discard the filter membrane (Figure 1, #9) and o-ring (Figure 1, #8).
4. Clean the filter housing.
5. Insert a new filter membrane and o-ring.  
(Filter Replacement Kit, SKC Catalog No. P22409)
6. Reattach the front filter housing and cross-tighten the four screws.

### **Pump Service**

Pumps under warranty should be sent to SKC Inc. for servicing (see Service p. 12). For further information on pump maintenance, testing and replacing pump components, and troubleshooting, request the Universal Pump Service Manual (SKC Publication No. 1377).

*Notice: This operating instruction may not address all safety concerns (if any) associated with this product and its use. The user is responsible for determining and following the appropriate safety and health practices and regulatory limitations (if any) before using the product. The information contained in this document should not be construed as legal advice, opinion, or as a final authority on legal or regulatory procedures.*

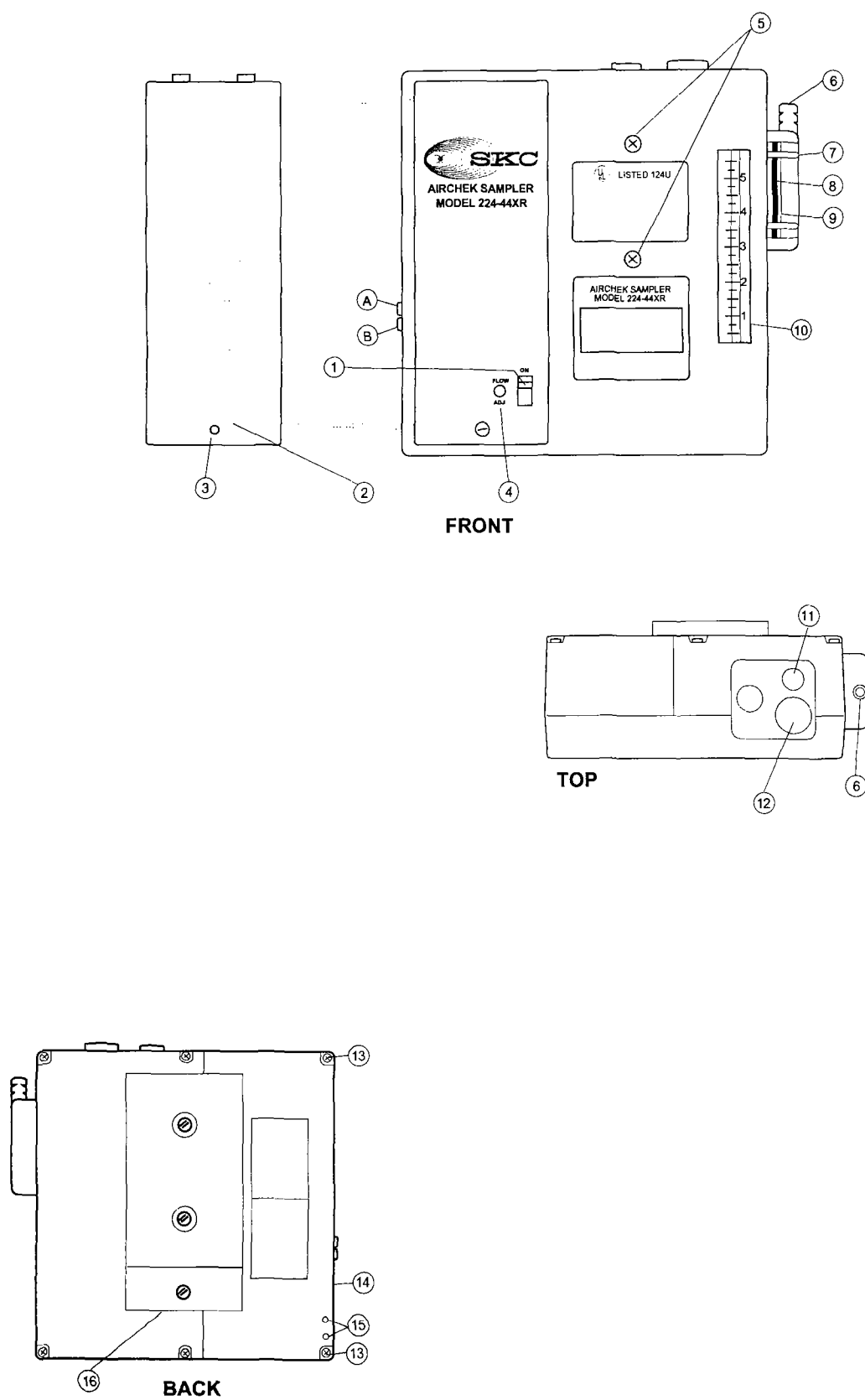
## **Diagrams/Part Description for Figure 1**

### **Model 224-44XR**

#### **No. Description**

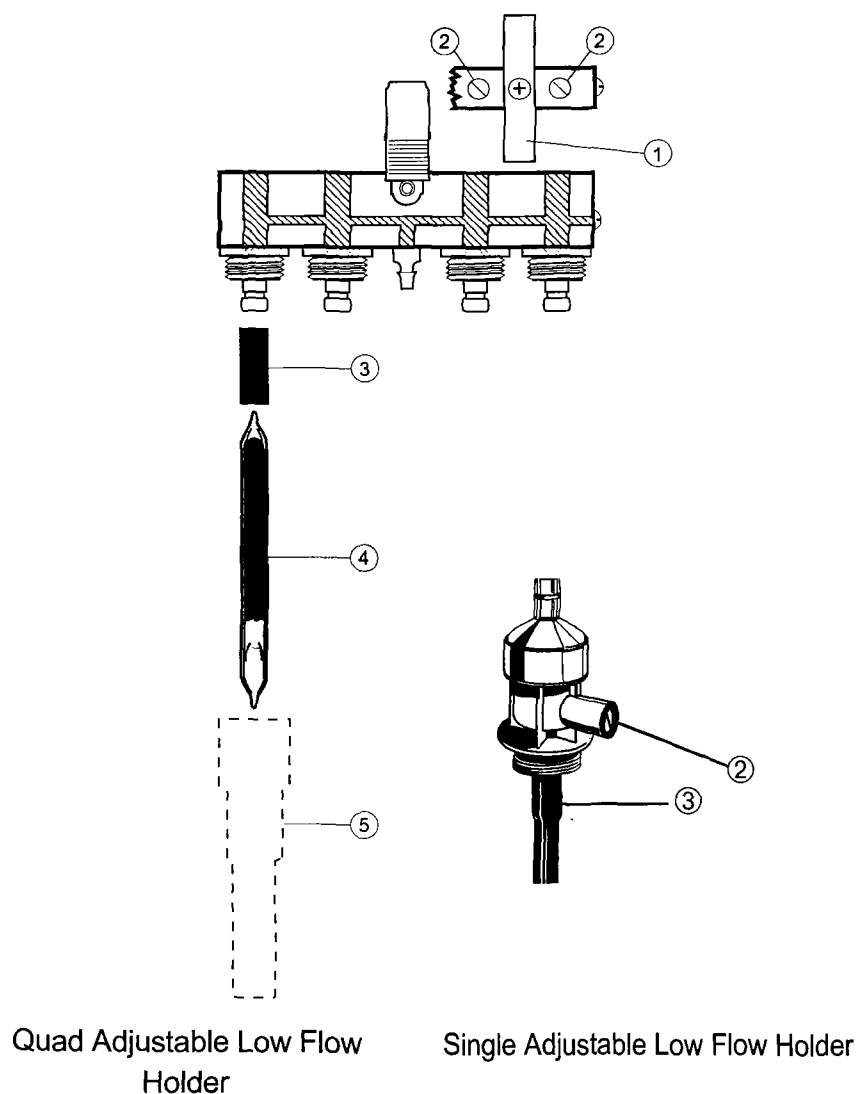
- 1 **ON/OFF Switch**
- 2 **Anti-tamper cover.** Protects controls from accidental contact or tampering.
- 3 **Cover Screw.** Fastens anti-tamper cover.
- 4 **Flow Adjustment Control.** Adjust flow from 750-5000 ml/min.
- 5 **Accessory Mounting Screws (2).** Secure accessories such as impinger and trap holders.
- 6 **Filter Housing (intake).** Air intake port and trap.
- 7 **Filter Housing Screws (4).** Secure filter housing.
- 8 **Filter O-ring.** Leak seal for filter in housing.
- 9 **Filter (10 micron nylon).** Filters particulates before entering pump.
- 10 **Built-in Flowmeter.** Monitors flow changes.
- 11 **Regulator Isolation Cap.** Accesses regulator isolation valve.
- 12 **Exhaust Port Cap .** Accesses exhaust port.
- 13 **Battery pack screws (2).** Secures pack to pump.
- 14 **Battery Pack Assembly.** Provides power to pump.
- 15 **Charging Jack.** Connector for battery charger.
- 16 **Belt Clip.** Secures pump to worker.
- A **Compensation Pot A.** Adjusts pump compensation which is factory set. Access screw guards against accidental contact or tampering.
- B **Compensation Pot B.** Adjust pump compensation which is factory set. Access screw guards against accidental contact or tampering.

**Figure 1**





**Figure 2**

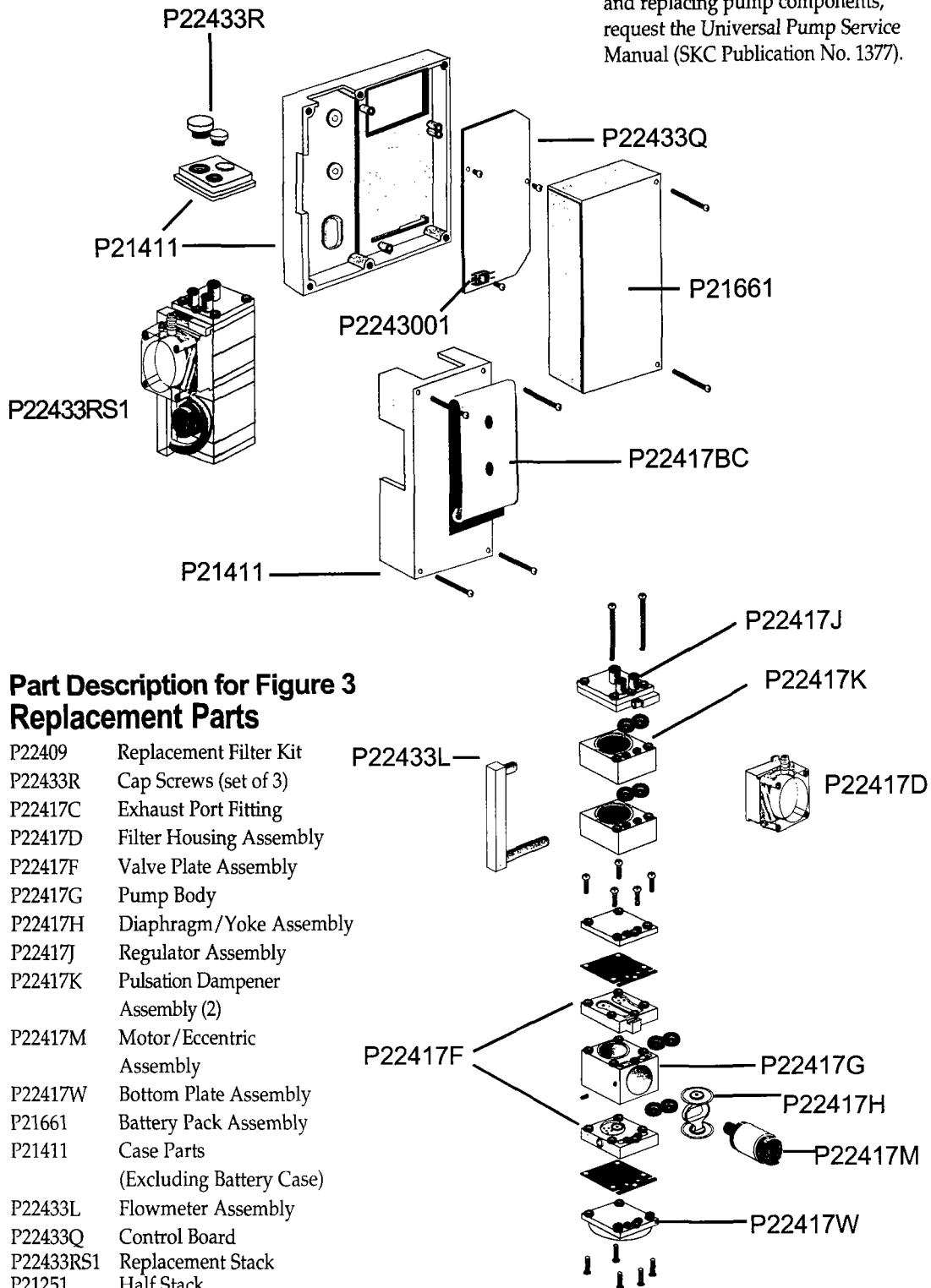


**Figure 2 - Adjustable Low Flow Holder**

1. Anti-tamper Cover
2. Manifold Flow Adjustment
3. Rubber Sleeve
4. Sorbent Sample Tube
5. Protective Cover

# Figure 3 — Replacement Parts for 244-44XR

For further information on testing and replacing pump components, request the Universal Pump Service Manual (SKC Publication No. 1377).



## Part Description for Figure 3 Replacement Parts

P22409	Replacement Filter Kit
P22433R	Cap Screws (set of 3)
P22417C	Exhaust Port Fitting
P22417D	Filter Housing Assembly
P22417F	Valve Plate Assembly
P22417G	Pump Body
P22417H	Diaphragm/Yoke Assembly
P22417J	Regulator Assembly
P22417K	Pulsation Dampener Assembly (2)
P22417M	Motor/Eccentric Assembly
P22417W	Bottom Plate Assembly
P21661	Battery Pack Assembly
P21411	Case Parts (Excluding Battery Case)
P22433L	Flowmeter Assembly
P22433Q	Control Board
P22433RS1	Replacement Stack
P21251	Half Stack
P2240901	Filters (pk/10)
P2240902	Filter/O-ring (100 ea)
P22417BC	Belt Clip
P2243201	Charging Jack (pk/5)
P22433C	Cover Plate
P22433ES	External Screws

Exploded view of stack # P22433RS1

## **Optional Accessories**

### **Adjustable Low Flow Holders:**

- 224-26-01 Single Holder
- 224-26-02 Dual Holder
- 224-26-03 Tri Holder
- 224-26-04 Quad Holder

### **Protective Sample Tube Covers:**

*for tubes up to:*

- 224-29A 70 mm long
- 224-29B 110 mm long
- 224-29C 150 mm long
- 224-29D 220 mm long
- 224-29T 115 mm with tandem trap tube cover

### **Battery Chargers:**

- 223-226 Single Battery Charger 115 V
- 223-227 Single Battery Charger 230 V
- 223-426 Deluxe 5 Station Battery Charger, Switchable for 115 or 230 V operation

### **Miscellaneous:**

- 224-11 Sampler Tool Kit
- 224-95 Protective Nylon Pouch with belt and shoulder strap, brown
- 224-95A Protective Nylon Pouch with belt and shoulder strap, red

## Service Policy

Product to be serviced should be sent, freight prepaid, to:

SKC Inc.  
National Service Center  
863 Valley View Road  
Eighty Four, PA 15330

Care should be taken in packaging to prevent damage in transit. Please include a contact name and phone number, shipping address, and a brief description of the problem. For nonwarranty repairs, a purchase order number and billing address is also required. The Service Center will contact nonwarranty customers with an estimate before proceeding with repairs.

## SKC QualityCare

QualityCare is a cost-effective preventive maintenance program that assures that pumps are tested, repaired, and calibrated on an annual basis. Participants will receive certificates of compliance for each pump, each year, to demonstrate adherence to Occupational Health and Safety Management Systems or company quality programs.

For more information on QualityCare call our SKC Customer Service Team at 724 941-9701.

**Note:** SKC Inc. will accept for repair any SKC product which is *not* contaminated with hazardous materials. Products determined to be contaminated will be returned unserviced.

## SKC INC. LIMITED ONE YEAR WARRANTY

1. SKC warrants that its instruments provided for industrial hygiene, air pollution, gas analysis, and safety and health applications are free from defects in workmanship and materials under normal and proper use in accordance with operating instructions provided with said instruments. The term of this warranty begins on the date the instrument is delivered to the buyer and continues for a period of one (1) year.

This warranty does not cover claims due to abuse, misuse, neglect, alteration, accident, or use in application for which the instrument was neither designed nor approved by SKC Inc. This warranty does not cover the buyer's failure to provide for normal maintenance, or improper selection or misapplication. This warranty shall further be void if changes or adjustments to the instrument are made by other than an employee of the seller, or if the operating instructions furnished at the time of installation are not complied with.

2. SKC Inc. hereby disclaims all warranties either expressed or implied, including any implied warranties of merchantability or fitness for a particular purpose, and neither assumes nor authorizes any other person to assume for it any liability in connection with the sale of these instruments. No description of the goods being sold has been made a part of the basis of the bargain or has created or amounted to an express warranty that the goods will conform to any such description. Buyer shall not be entitled to recover from SKC Inc. any consequential damages, damages to property, damages for loss of use, loss of time, loss of profits, loss of income, or other incidental damages. Nor shall buyer be entitled to recover from SKC Inc. any consequential damages resulting from defect of the instrument including, but not limited to, any recovery under section 402A of the Restatement, Second of Torts.

3. This warranty extends only to the original purchaser of the warranted instrument during the term of the warranty. The buyer may be required to present proof of purchase in the form of a paid receipt for the instrument.

4. This warranty covers the instrument purchased and each of its component parts.

5. In the event of a defect, malfunction, or other failure of the instrument not caused by any misuse or damage to the instrument while in possession of the buyer, SKC Inc. will remedy the failure or defect without charge to the buyer. The remedy will consist of service or replacement of the instrument. SKC Inc. may elect refund of the purchase price if unable to provide replacement and repair is not commercially practicable.

6. (a) To obtain performance of any obligation under this warranty, the buyer shall return the instrument, freight prepaid, to SKC Inc., at the following address:

SKC Inc., National Service Center  
863 Valley View Road  
Eighty Four, PA 15330 USA

(b) To obtain further information on the warranty performance you may telephone 412- 941-9701 at the address above.

7. This warranty shall be construed under the laws of the Commonwealth of Pennsylvania which shall be deemed to be the situs of the contract for purchase of SKC Inc. instruments.

8. No other warranty is given by SKC Inc. in conjunction with this sale.

Form #3755 Rev 9612

**ATTACHMENT E**  
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## SOP FOR HACH INSTRUMENTS DIGITAL TITRATOR (OR EQUIVALENT)

### **Purpose**

The concentration of carbon dioxide (CO<sub>2</sub>) in groundwater can be estimated using a digital titrator. This SOP summarizes the procedure for utilizing a Hach Digital Titrator with Sodium Hydroxide (NaOH). Note that this procedure references the attached documentation provided by Hach.

### **Procedure**

1. Select a sample size and a NaOH Titration Cartridge corresponding to the expected CO<sub>2</sub> concentration (refer to Table provided by manufacturer). If the expected concentration is unknown, start with a smaller sample volume and determine its approximate concentration. Retest with the appropriate sample size.
2. Insert the appropriate titration cartridge into the Titrator receptacle and lock it in position with a slight turn.
3. Remove the polyethylene cap from the end of the cartridge and insert a clean delivery tube.
4. When a cartridge is first attached to the digital Titrator, the piston must be engaged and the delivery tube must be flushed. Holding the Titrator with the tip of the cartridge pointing up, push the plunger release button in and toward the cartridge. Turn the delivery knob until the air is expelled and several drops of titration fluid flow from the tip. Reset the counter to zero, then wipe or rinse the tip with deionized water.
5. Collect the appropriate groundwater sample volume into an Erlenmeyer flask.
6. Add the contents of one phenolphthalein indicator powder pillow or 4 drops of phenolphthalein indicator solution and mix. If a pink color forms, no CO<sub>2</sub> is present.
7. Immerse the delivery tube tip into the solution and swirl the flask gently while titrating with NaOH from colorless to a light pink color that persist for 30 seconds. Inaccurate results will be obtained if the delivery tube tip is not immersed in the solution.
8. Record the number of digits that appear in the digital counter window
9. Calculate the concentration as follows:

Number of digits X digit multiplier = CO<sub>2</sub> concentration (mg/L)

The digit multiplier is included in a table provided by the manufacturer.

10. Upon completion, press the plunger release button and manually retract the plunger into the body of the Titrator. Remove the cartridge. Remove the delivery tube and reseal the cartridge with the polyethylene cap.
11. Discard or clean the delivery tube immediately after use.

### **Sample Collection**

1. Collect samples in clean plastic or glass bottles.
2. Avoid excess agitation or prolonged exposure to air.



3. Analyze samples as soon as possible after collection.
4. If immediate analysis is not possible, the samples may be stored for 24 hours or less by cooling to 4° C or below. Warm samples to room temperature before analysis.
5. Highly colored or turbid samples may mask the color change of the end point. For these samples, titrate to a pH of 8.3 using a pH meter.

### **Solution Check**

Sodium hydroxide standard solutions lose strength with age and should be checked periodically by titrating a known standard. Check the solution by titrating 50 ml of Potassium Acid Phthalate standard solution, 100 mg/L CO<sub>2</sub>, using Phenolphthalein Indicator solution. The titration should require 5.00 ml of titrant. If the volume required is greater than 5.25 ml, discard the sodium hydroxide and replace with a fresh supply.

### **Accuracy Check**

#### **Standard Additions Method**

This accuracy check should be performed when interferences are suspected or to verify analytical technique.

1. Snap the neck off a Carbon Dioxide Voluette Ampule Standard for Carbon Dioxide, 10,000 mg/L CO<sub>2</sub>.
2. Use a TenSette Pipet (Cat. No. 19700-01) to add 0.1 mL of standard to the sample titrated in step 6. Resume titration back to the same end point. Record the number of digits required.
3. Repeat, using additions of 0.2 mL and 0.3 mL. Titrate to the same end point after each addition.
4. Each 0.1 addition of standard should require 50 additional digits of 0.3636 N titrant or five digits of 3.636 N titrant. If these uniform increases do not occur, refer to Section 3.2.2 (Standard Additions) of the Operating Instructions Manual.

### **Required Reagents (varies with sample characteristics)**

<b>Description</b>	<b>Unit</b>	<b>Cat. No.</b>
Carbon Dioxide Reagent Set (about 100 tests).....		22727-00
Includes:		
Phenolphthalein Powder Pillows.....	100/pkg.....	942-99
Sodium Hydroxide Titration Cartridge, 0.3636 N.....	each.....	14378-01
Sodium Hydroxide Titration Cartridge, 3.636 N.....	each.....	14380-01
Water, deionized.....	4 L.....	272-56

**Required Apparatus**

Digital Titrator .....each..... 16900-01

Select one or more based on sample concentration:

Flask, Erlenmeyer, 250-mL.....each..... 505-46

Flask, Erlenmeyer, 125-mL.....each..... 505-43

**Required Standards**

Carbon Dioxide Standard Solution, Voulette® Ampule,

10,000-mg/L as CO<sub>2</sub>, 10-mL..... 16/pkg ..... 14275-10

Phenolphthalein Indicator Solution, 5-g/L..... 100 mL MDB ..... 162-32

Potassium Acid Phthalate Standard Solution, 100-mg/L as CO<sub>2</sub> 100 mL.....2261-42

## Method 8205

## Digital Titrator Method Using Sodium Hydroxide

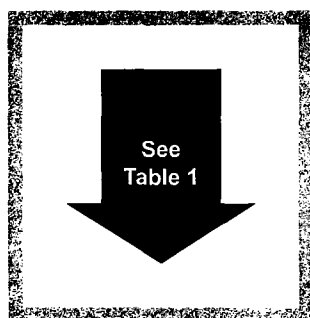
### Digital Titrator

(10 to 1000 mg/L as CO<sub>2</sub>)

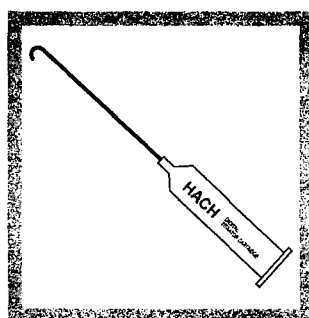
Scope and Application: For water and seawater



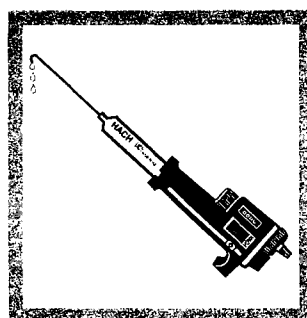
- For added convenience when stirring, use the TitraStir apparatus (Cat. No. 19400-00, -10).
- For more accurate results, check the calibration of the Erlenmeyer flask. Fill a graduated cylinder with the sample volume of deionized water. Pour the water into the Erlenmeyer flask and mark the proper level with a wax pencil or permanent marker.
- Four drops of Phenolphthalein Indicator Solution (Cat. No. 162-32) can be substituted for the Phenolphthalein Indicator Powder Pillow.
- Minimize agitation of the sample to avoid loss of carbon dioxide.



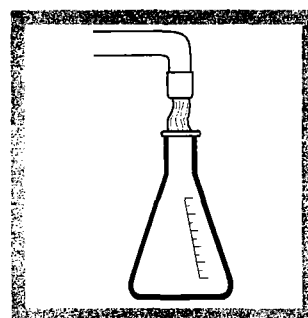
1. Select a sample size and a Sodium Hydroxide (NaOH) Titration Cartridge in *Table 1* that correspond to the expected carbon dioxide (CO<sub>2</sub>) concentration.



2. Insert a clean delivery tube into the titration cartridge. Attach the cartridge to the titrator body.

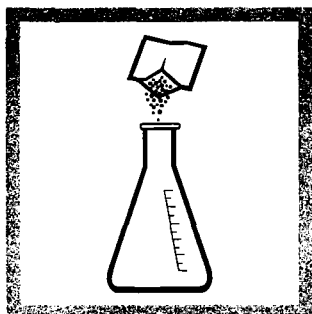


3. Turn the delivery knob to eject a few drops of titrant. Reset the counter to zero and wipe the tip.



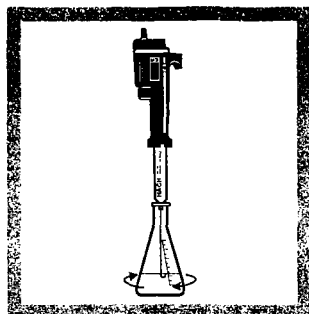
4. Collect a water sample directly into the titration flask by filling to the appropriate mark.

## Carbon Dioxide

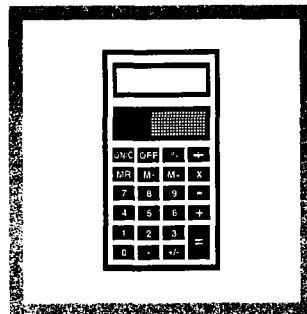


5. Add the contents of one Phenolphthalein Indicator Powder Pillow and mix.

If a pink color forms, no carbon dioxide is present.



6. Place the delivery tube into the solution and swirl the flask gently while titrating with sodium hydroxide from colorless to a light pink color that persists for 30 seconds (pH 8.3). Record the number of digits required.



7. Calculate:

Total Digits Required x Digit

Multiplier = mg/L as CO<sub>2</sub>

Table 1

Range (mg/L as CO <sub>2</sub> )	Sample Volume (mL)	Titration Cartridge (N NaOH)	Catalog Number	Digit Multiplier
10–50	200	0.3636	14378-01	0.1
20–100	100	0.3636	14378-01	0.2
100–400	200	3.636	14380-01	1.0
200–1000	100	3.636	14380-01	2.0

### Interferences

Highly colored or turbid sample may mask the color change of the end point. Use a pH meter (Cat. No. 51700-10) for these samples, titrating to pH 8.3. Other acid components in the sample will be titrated and interfere directly in this determination.

Sodium hydroxide standard solutions tend to lose strength slowly with age and should be checked periodically by titrating a known standard. Check the solution frequently (monthly) by titrating 50 mL of Potassium Acid Phthalate Standard Solution, 100 mg/L CO<sub>2</sub>, using Phenolphthalein Indicator Solution. The titration should require 5.00 mL of titrant. If the volume required for this titration is greater than 5.25 mL, discard the sodium hydroxide and replace it with a fresh supply.

### Sampling and Storage

Collect samples in clean plastic or glass bottles. Fill completely and cap tightly. Avoid excessive agitation or prolonged exposure to air. Analyze samples as soon as possible after collection. If immediate analysis is not possible, the samples may be stored for at least 24 hours by cooling to 4 °C (39 °F) or below. Before analysis, warm the samples to room temperature.

## Accuracy Check

### Standard Additions Method

This accuracy check should be performed when interferences are suspected or to verify analytical technique.

1. Snap the neck off a Carbon Dioxide Voluette Ampule Standard for Carbon Dioxide, 10,000 mg/L CO<sub>2</sub>.
2. Use a TenSette Pipet (Cat. No. 19700-01) to add 0.1 mL of standard to the sample titrated in step 6. Resume titration back to the same end point. Record the number of digits required.
3. Repeat, using additions of 0.2 mL and 0.3 mL. Titrate to the same end point after each addition.
4. Each 0.1 addition of standard should require 50 additional digits of 0.3636 N titrant or five digits of 3.636 N titrant. If these uniform increases do not occur, refer to *Section 3.2.2 Standard Additions* on page 46.

## Summary of Method

Acidity due to carbon dioxide in a sample is titrated with sodium hydroxide to a phenolphthalein end point. Strong acids are assumed to be absent or of insignificant concentration. See *Appendix A, Chemical Procedures Explained*.

### Required Reagents (varies with sample characteristics)

Description	Unit	Cat. No.
Carbon Dioxide Reagent Set (about 100 tests) .....		22727-00
Includes:		
Phenolphthalein Powder Pillows .....	100/pkg.....	942-99
Sodium Hydroxide Titration Cartridge, 0.3636 N.....	each .....	14378-01
Sodium Hydroxide Titration Cartridge, 3.636 N.....	each .....	14380-01
Water, deionized .....	4 L .....	272-56

### Required Apparatus

Digital Titrator.....	each.....	16900-01
Select one or more based on sample concentration:		
Flask, Erlenmeyer, 250-mL.....	each.....	505-46
Flask, Erlenmeyer, 125-mL.....	each.....	505-43

### Required Standards

Carbon Dioxide Standard Solution, Voluette® Ampule, 10,000-mg/L as CO <sub>2</sub> , 10-mL.....	16/pkg.....	14275-10
Phenolphthalein Indicator Solution, 5-g/L .....	100 mL MDB.....	162-32
Potassium Acid Phthalate Standard Solution, 100-mg/L as CO <sub>2</sub> .....	100 mL.....	2261-42

## Section 6 Step-by-Step Guide to Hach Instruments

### 6.1 The Digital Titrator

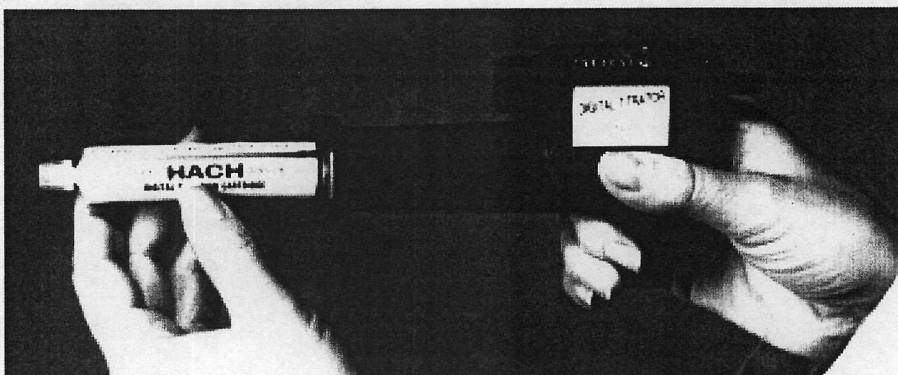
To use the Digital Titrator:

1. Estimate the expected sample concentration from the table given in each procedure and select a sample volume and titration cartridge accordingly.

**Note:** If the expected sample concentration is not known, start with a smaller sample volume and determine its approximate concentration. Retest with the appropriate sample size.

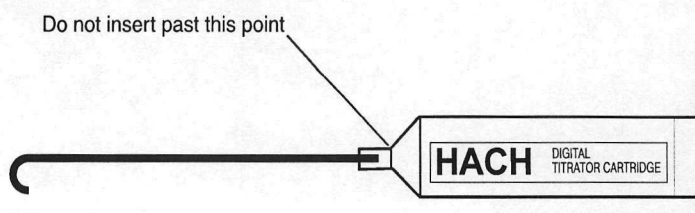
2. Slide the cartridge into the titrator receptacle and lock it in position with a slight turn. See Figure 1.

Figure 1 Sliding the Cartridge into Place



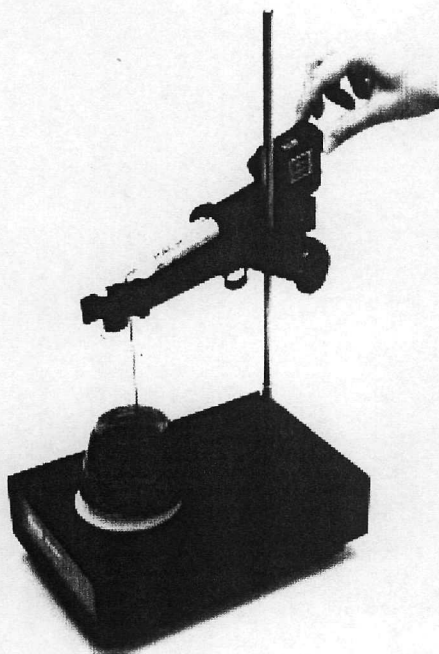
3. Remove the polyethylene cap from the end of the cartridge and insert a clean delivery tube. See Figure 2. Use a delivery tube with a straight barrel for hand-held titrations; use a delivery tube with a 90° bend for stationary setups. Do not insert tube past the cartridge extension (see illustration below). Sometimes the tube may have a small burr on the leading edge that must be removed before it can be inserted.

Figure 2 Inserting the Delivery Tube

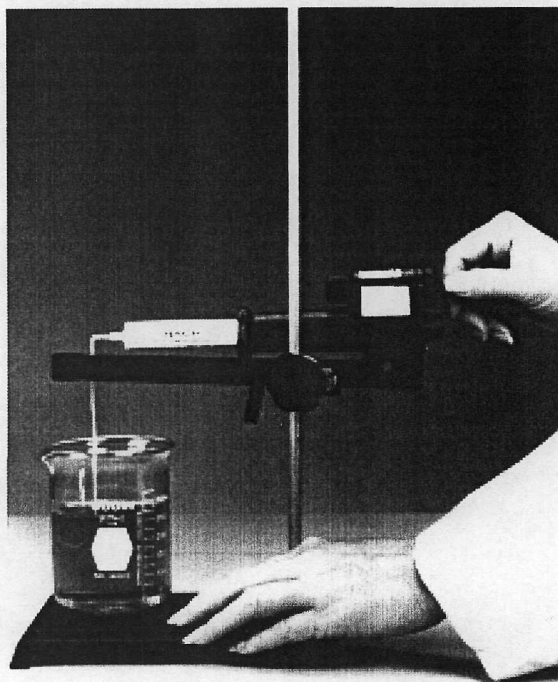


4. The Digital Titrator may be mounted on a support for stationary titrations; use a TitraStir® or a clamp holder and clamp to attach the titrator to a laboratory stand. (See Figure 3 and Figure 4.) The TitraStir also stirs the sample at a constant speed, leaving the analyst free to detect the endpoint.
5. When a cartridge is first attached to the Digital Titrator, the piston must be engaged and the delivery tube must be flushed. To do this:
  - a. Hold the titrator with the tip of the cartridge pointing up. Advance the plunger release button to engage the piston with the cartridge (push the button in and toward the cartridge.)

**Figure 3 Using the TitraStir**



**Figure 4 Using a Laboratory Stand**



- b. Turn the delivery knob until all the air is expelled and several drops of solution flow from the tip.
- c. Use the counter reset knob to turn the digital counter back to zero. Wipe the tip, or rinse it with deionized water.
6. Measure the sample volume in the smallest appropriate graduated cylinder or pipette. Transfer the sample into a 125-mL or 250-mL erlenmeyer flask. Dilute with deionized water if necessary.

**Note:** Sample dilutions must be made accurately. However, final total volume of titrated solution is not critical.

7. Add the necessary reagents to the sample and swirl to mix.
8. Immerse the delivery tube tip in the solution and swirl the flask while titrating. Inaccurate results will occur if the delivery tube tip is held above the solution.
9. Titrate by turning the delivery knob. Keep turning the knob and swirling the sample until the end point is reached. Record the number of digits that appear in the digital counter window.

**Note:** The digital titrator procedures are designed so that the number of digits required will usually range from 100 to 400. If the digits required are less than 100 or more than 400, use an alternate sample volume or titrant cartridge.

10. Calculate the concentration of your sample by using the formula:

**Note:**  $\text{Digits Required} \times \text{Digit Multiplier} = \text{Sample Concentration}$

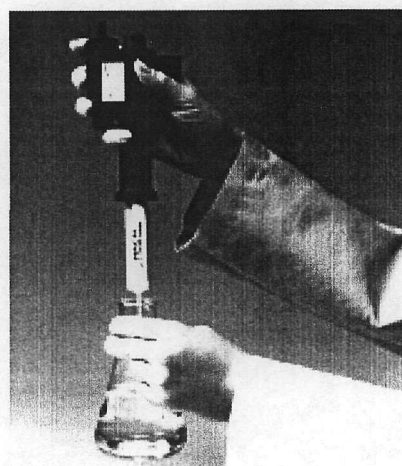
**Where:**

Digits Required = the number that appeared in the digital counter window in step 9.

**Note:** Digit Multiplier = the number from the table given in the procedure. It takes into account the sample dilution and titrant strength.



**Figure 5 Titrating the Sample**



11. At the end the testing session, press the plunger release button and manually retract the plunger into the body of the titrator. Remove the cartridge. Remove the delivery tube and reseal the cartridge with the polyethylene cap. (See *Figure 6*.)

**Figure 6 Retracting the Plunger**



12. Discard or clean the delivery tube immediately after use. To clean, force water, then air, through the tube with a syringe or wash bottle.

### Optional Apparatus for Use with the TitraStir:

Description	Quantity Required		Unit	Cat. No.
	Per Test			
Delivery Tubes, 90° with hook for TitraStir .....	1		5/pkg.....	41578-00
TitraStir Mixer/Stand Assembly,				
115 VAC .....	1		each.....	19400-00
230 VAC .....	1		each.....	19400-10
Stir Bar, 28.6 x 7.9 mm .....	1		each.....	20953-52
Flask, Erlenmeyer, 250-mL .....	1		each.....	505-46

---

## 6.2 The TenSette Pipet

The TenSette Pipet comes with 100 disposable tips, and more can be ordered from Hach. Ideally, a new tip should be used for each dispensation, although it is acceptable to use the same tip several times when pipetting from the same solution. After several uses, however, the pipet tip may retain some liquid and cause inaccurate delivery.

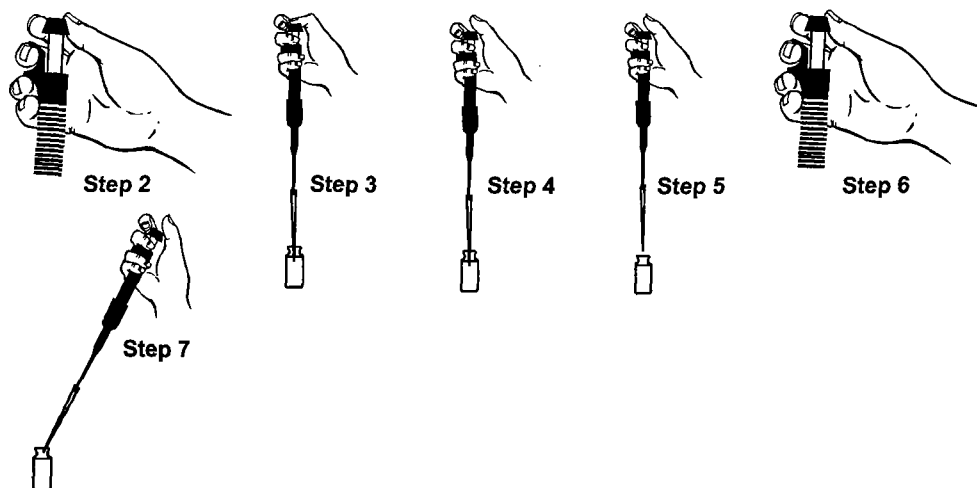
Always use careful, even hand movements. If the pipet does not operate smoothly, disassemble it and coat the piston and retainer with high-quality stopcock grease. Also coat the metering turret lightly with grease. Refer to the TenSette Pipet manual.

The solution being pipetted should be at room temperature (20–25 °C).

Never lay the pipet down while there is liquid in the tip. Some of the solution might leak into the pipet and corrode it.

### 6.2.1 Operating the TenSette Pipet

1. Attach a clean tip by holding the pipet body in one hand and gently pressing the large end of the pipet tip onto the tapered end of the pipet. Be sure to get a good seal.
2. Turn the turret cap to align the desired volume with the mark on the pipet body.
3. Using a smooth motion, press down on the turret cap until it reaches the stop. Immerse the tip about 5 mm ( $\frac{1}{4}$  inch) below the solution surface to avoid drawing air into the pipet. Do not insert the tip too deep.
4. While maintaining a constant pressure, allow the turret to return slowly to the extended position. A rapid return may affect the delivery volume.
5. With the turret up, take the tip out of the solution and move it to the receiving vessel. Do not press on the turret cap while moving the pipet.
6. Use your thumb and forefinger to twist the turret cap to the next higher volume position to ensure quantitative transfer of the sample. The "F" position provides full blowout.
7. With the tip in contact with the side of the receiving vessel, slowly and smoothly press down on the turret cap until it reaches the stop and the solution is completely discharged.



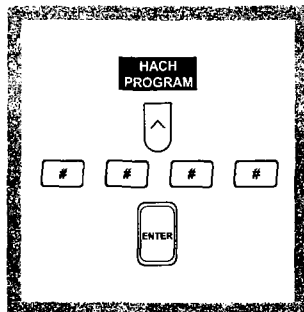
## 6.3 Spectrophotometers and Colorimeters

The following typical procedures are meant as an overview. Specific sample volumes, reagents, sample cells, and timing intervals vary depending on which procedure and which Hach instrument you are using. Refer to the procedure manual for your instrument for specific instructions.

### 6.3.1 The DR/4000 Spectrophotometer (Typical Procedure)



1. Install the correct sample cell adapter in the sample cell module.



2. Press the soft key under **HACH PROGRAM**. Enter the appropriate stored program number with the numeric keys. Press **ENTER**.



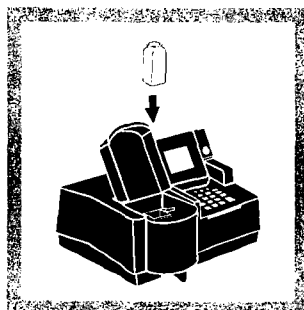
3. Prepare the sample and blank solution (if necessary) for measurement as described in the test procedure.



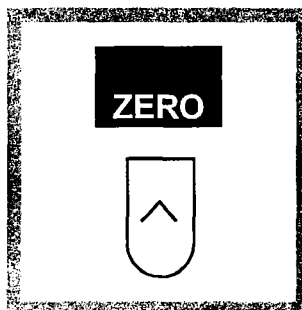
4. Fill a clean sample cell with the required amount of sample for the test (the *sample*). Add the appropriate reagents and mix.



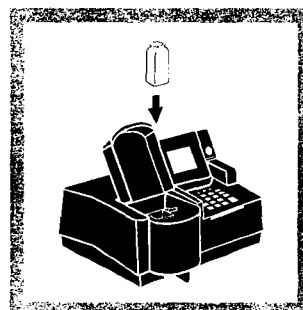
5. Fill another clean sample cell with the required amount of reagent blank (the *blank*). Add the appropriate reagents and mix.



6. Place the blank into the cell compartment and close the lid.

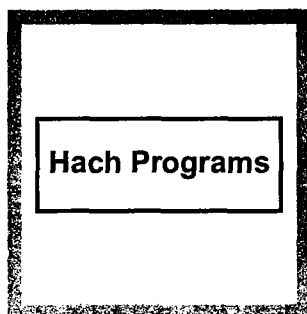


7. The display will read **ZERO**.

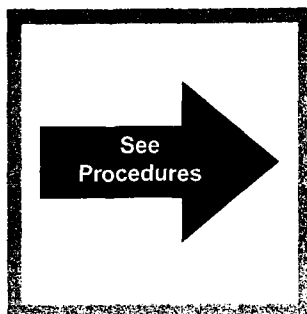


8. Remove the blank from the sample cell, replace it with the sample, and close the lid. The results will be displayed.

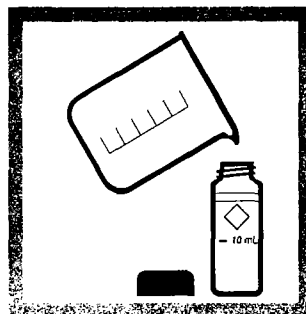
### 6.3.2 The DR/2500 Spectrophotometer (Typical Procedure)



1. Touch  
**Hach Programs.**  
Select program  
Touch **Start.**



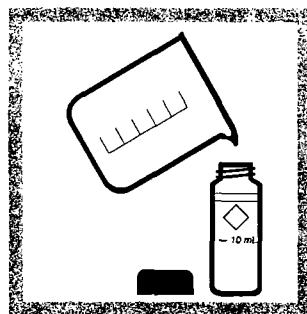
2. Prepare the sample and blank solution (if necessary) for measurement as described in the test procedure.



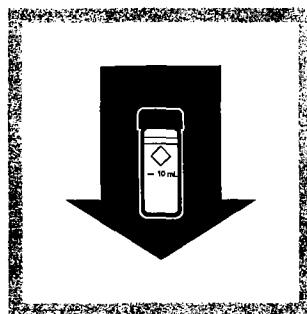
3. Fill a clean sample cell with sample.



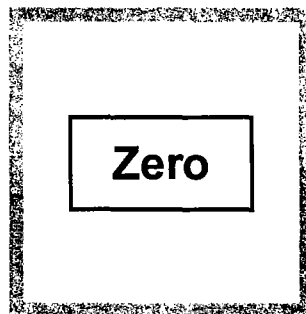
4. Add the required reagents to the sample cell (the prepared sample). Swirl to mix. Activate the timer where required.



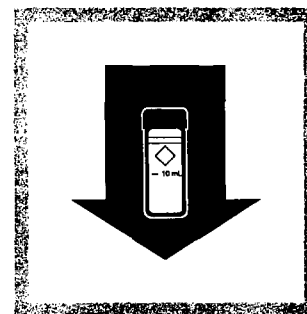
5. Fill a second sample cell with sample (the blank).  
Add the required reagents and mix.



6. When the timer beeps, place the blank into the cell holder.



7. Touch **Zero.**  
The display will show:  
**0 mg/L**

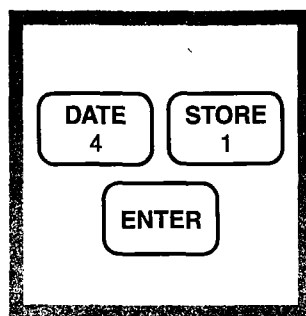


8. Place the prepared sample into the cell holder.  
Results will appear in mg/L, or other specified units.

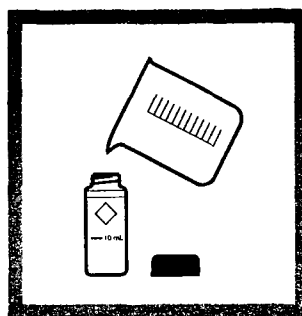
### 6.3.3 The DR/800 Colorimeter (Typical Procedure)



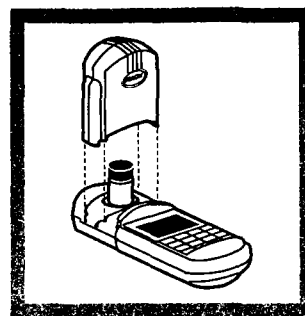
1. Press the **PRGM** key.



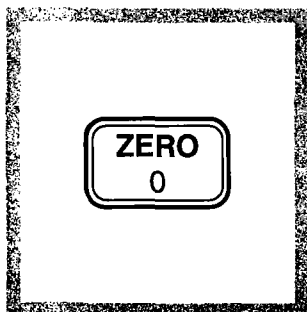
2. Enter the desired program number by pressing the numerical keys to display the program number.  
Press **ENTER**.



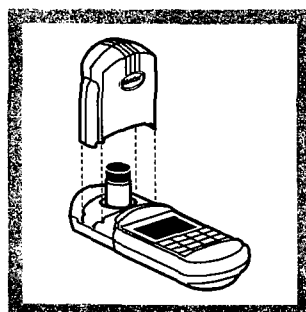
3. Prepare the sample for measurement as described in the applicable test procedure. If the reagent blank also needs treatment, prepare it at this time.



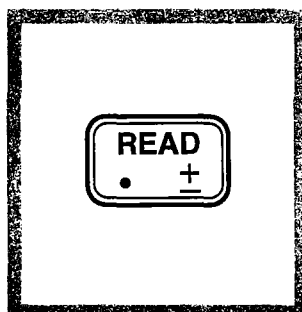
4. Place the sample cell containing the blank solution into the sample compartment



5. Zero the instrument by pressing the **ZERO** key. The display will count down to 0. Then the display will show zero concentration and the units concentration.

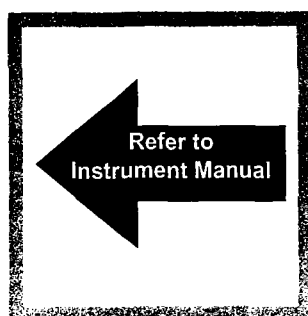


6. Place the sample cell containing the prepared sample into the sample compartment.

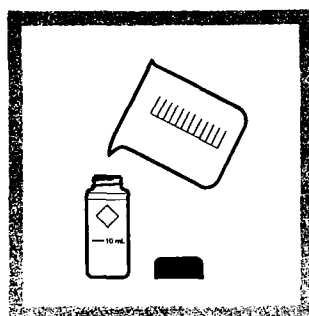


7. Press the **READ** key. The display will count down to zero. Then it will show the results in concentration units.

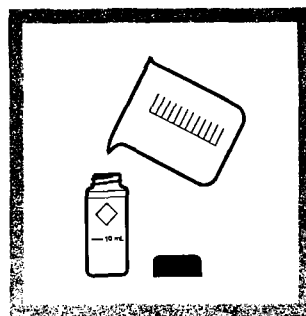
### 6.3.4 The Pocket Colorimeter (Typical Procedure\*)



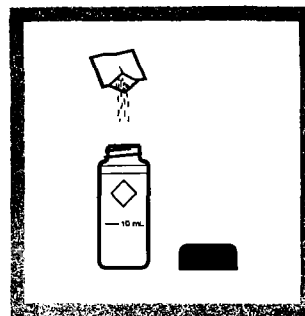
1. If your Pocket Colorimeter Instrument requires you to select a range before testing, read the *HI or LO Range Mode* section in the instrument manual, and set the appropriate range.



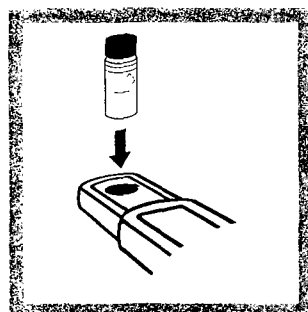
2. Fill a clean sample cell to the 10-mL mark with the blank solution (usually untreated sample).



3. Fill another clean sample cell to the 10-mL mark with sample.

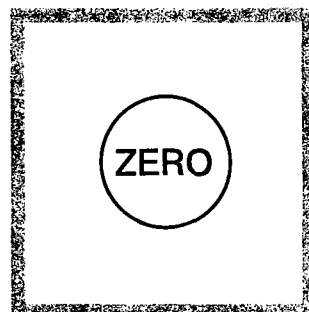


4. Add the reagents and mix. Wait the specified time period, where required.



5. Place the blank in the cell compartment with the diamond mark facing the keypad and cover the cell with the light shield.

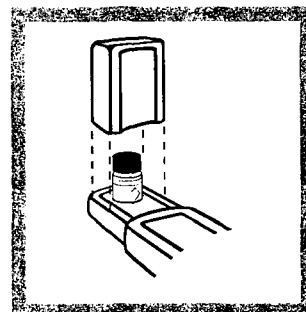
**Note:** When covering the sample cell, place the curved surface of the light shield closest to the keypad to provide a good seal against stray light.



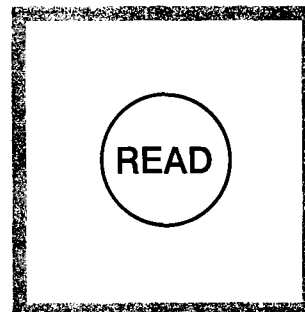
6. Press the **ZERO** key. After 2 seconds the display will read:

0.0  
or  
0.00

depending on the specified resolution.



7. Place the sample cell containing the sample into the cell compartment (diamond mark facing the keypad) and cover with the light shield.



8. Press the **READ** key. After about 2 seconds the instrument will display the results.

\* All instrument functions are performed using two keys and the digital display.

**SOP FOR YSI 600 XLM WATER QUALITY INSTRUMENT  
(OR EQUIVALENT)**

**Purpose**

To provide a maintenance and calibration procedure for the YSI 600 XLM.

**Materials and equipment required**

(4) AA batteries (SUP1000)  
pH 4 buffer solution (ORI1012)  
pH 7 buffer solution (ORI1013)  
pH 10 buffer solution (ORI1014)  
1mS/cm conductivity solution (YSI1014)  
Zobell solution (YSI1009)

**Procedure**

**Battery Replacement**

1. Grasp the sonde body with one hand and the battery cover with the other. Unscrew the battery cover and slide it up and over the bulkhead connector.
2. Remove the old batteries. Inset the new batteries, paying special attention to the polarity.
3. Check the O-ring and sealing surface for damage.
4. Apply a very thin coat of O-ring lubricant to the batter chamber O-rings.
5. Return the batter cover and tighten by hand. DO NOT OVER-TIGHTEN.

**Sonde Set-up Procedure with PC**

1. Connect the field cable to the db-9 connector on the PC. Use an adapter if needed.
2. Start the EcoWatch software by double clicking the EcoWatch for Windows icon.
3. Select the sonde icon from the toolbar, and then the proper Com port (1 or 2) to which your sonde is connected.
4. If the default setting is correct, it does not need to be changed. Click "OK" to open a terminal window.
5. A new window will open with a "#" symbol. Type "Menu" after the "#" symbol, press enter. The sonde main menu will now be displayed.

----- Main -----

- |             |            |
|-------------|------------|
| 1-Run       | 5-System   |
| 2-Calibrate | 6-Report   |
| 3-File      | 7-Sensor   |
| 4-Status    | 8-Advanced |

Select option (o for previous menu):

-----  
NOTE\* You can go back one screen at a time by using the **Esc** key.

### Setting the Date & Time

6. Select SYSTEM. Select DATE & TIME. Choose the time/date display format by pressing the number next to the format you want.
7. If the time needs adjusted, press 6. Input the time using the 24-hour clock format.
8. Select 4 so the date will be displayed as a 4-digit year.
9. If the date needs adjusted, press 5. Input the date using the mm/dd/yyyy format.
10. Press Esc to return to the System menu. Press Esc to return to the Main menu.

### Sensor Selection

11. Select 7-Sensor from the main menu.
12. Enter the corresponding number to enable the sensors that are installed on the sonde.
13. After all installed sensors have been enabled, press Esc to return to the main menu.

### Report Set-up

14. Select 6-Report from the main menu.
15. Select the following parameters:  
Date, Time, Temp C, SpCond mS/cm, DO %, DO chrg, Depth feet, pH, Orp mV, battery voltage.
16. Press Esc to return to the main menu.

### Sensor Calibration – pH, ORP, Conductivity

To ensure more accurate results, rinse the calibration cup with distilled water, then rinse with a small amount of the calibration solution for the sensor that you are going to calibrate. Discard the rinse solution and add fresh calibration solution.



17. Immerse the probes into the solution and rotate the calibration cup several times so that the calibration cup is screwed on but not all the way.
18. If possible, support the sonde by using a ring stand and clamp to prevent the sonde from falling over.
19. From the Main menu, select 2-Calibrate.
20. Select the first parameter you wish to calibrate and press Enter.
21. Once you have selected a parameter, some of the parameters will have a number that appears in parentheses. These are the default values and will be used during calibration if you press Enter without inputting another value. If no default value appears, you must type a numerical value and press Enter.
22. After you input the calibration value, or accept the default, press Enter. A real time display will appear on the screen. When the readings have been stable for approximately 30 seconds, press Enter to accept the calibration.
23. Press Enter to return to the Calibrate menu, and proceed to the next calibration.

**Note:** If an Error message appears, begin the calibration procedure again. Be certain that the value you enter for the calibration standard is correct.

#### **Sensor Calibration – Depth, DO %**

24. To calibrate DO, place a small amount (1/8") of water in the bottom of the calibration beaker. Make sure the calibration chamber is not tight. It must be vented to atmosphere.
25. Allow the sonde to sit for approx. 10 minutes for the air in the cal chamber to become saturated and the temperature to stabilize.
26. Select DO% from the calibration menu. Input the correct barometric pressure in mm of Hg.
27. Press Enter and the current values will be displayed. Observe the readings under DO%. When they show no significant change for approx. 30 seconds, press Enter.
28. The screen will indicate that the calibration has been accepted and prompt you to press Enter again to return to the calibration menu.
29. For the depth and level calibration, you can leave the sonde set-up the same way as for the DO probe.
30. Select Pressure-Abs from the calibration menu. Input 0.00 and press Enter.
31. Allow the readings to stabilize for 30 seconds or no significant change. Press Enter to accept the readings. Press Enter again to return to the calibration menu.
32. Calibration is now complete.

#### **Taking & Logging Readings**

1. Select 1-Run from the main menu.
2. Select 1-Discreet Sample from the Run Setup menu.

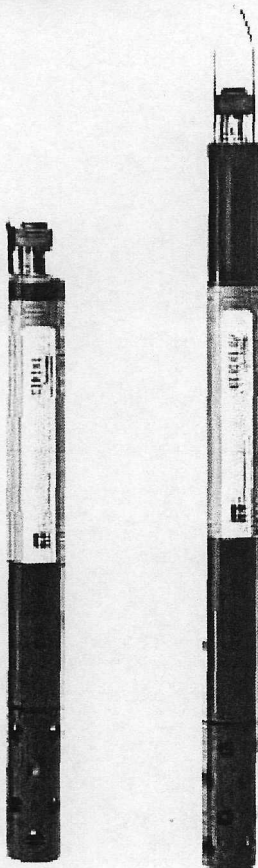
3. Select 2-Sample interval from the Discreet sample menu. Set the sample interval to 4 seconds.
4. If a file is listed, select 5-Close File. If no file is listed, go to the next step.
5. Select 3-0File from the Discreet sample menu. Enter a file name to log readings into.
6. Select 5-Open File from the Discreet sample menu.
7. Select 1-Start Sampling from the Discreet sample menu.
8. Select 2-Log ON/OFF. Data will not be stored in the file you named earlier.
9. Allow a few minutes of data to be stored. Select 2 to turn logging off.
10. Press Esc back to the main menu.
11. Select 3-File from the main menu.
12. Select 3-Quick Upload from the File menu.
13. Select 1-PC6000. You should see a box open with the file name and the data being transferred. When the transfer is completed Esc back to the main menu.

### **Viewing and Printing Data**

1. Click on the OPEN file icon. Select the file you just created.
2. Depending on how the last file was opened, you may see the data as a graph or as text.
3. From the tool bar, select the VIEW option. Select or de-select the graph or table option to your preference.
4. Print a copy of the data for QC and the customer. Please print the data as text and not a graph.
5. END OF PROCEDURE.



Y S I Environmental



The YSI 600XL and 600XLM.

**Compatible with  
EcoWatch® for  
Windows® software for  
data analysis and more!**

## YSI 600XL and 600XLM Sondes

### Measure multiple parameters simultaneously

The YSI 600XL and YSI 600XLM compact sondes measure eleven parameters simultaneously:

DO (% and mg/L)	ORP
Temperature	Depth or Level
Conductivity	Total Dissolved Solids*
Specific Conductance*	Resistivity*
Salinity*	pH

### Connect with Data Collection Platform

Either sonde can easily connect to the YSI 6200 DAS (Data Acquisition System), or your own data collection platform, via SDI-12 for remote and real-time data acquisition applications.

### In addition

The YSI 600XLM is an economical logging system for long-term, *in situ* monitoring and profiling. It will log all parameters at programmable intervals and store 150,000 readings. At one-hour intervals, the instrument will log data for about 75 days utilizing its own power source. The 600XL can also be utilized in the same manner with user-supplied external power.

- Either sonde fits down 2-inch wells
- Horizontal measurements in very shallow waters
- Stirring-independent Rapid Pulse™ dissolved oxygen sensor
- Field-replaceable sensors
- Easily connects to data collection platforms such as the YSI 6200 DAS
- Available with detachable cables to measure depth up to 200'
- Compatible with YSI 650 Multiparameter Display System
- Use with the YSI 5083 flow cell for groundwater applications

\* Calculated parameters.



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Data for a  
Healthy  
Planet.

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Fax 86 532 389 6647  
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**ISO 9001  
ISO 14001**

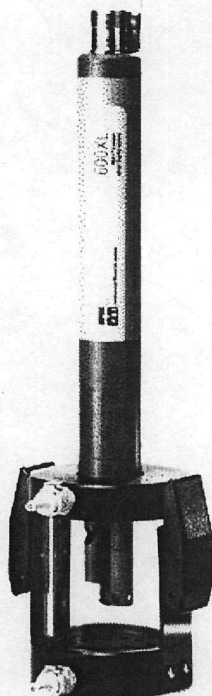
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YSI Environmental  
Who's Minding  
the Planet?

## 600XL & 600XLM Sensor Specifications

<b>Dissolved oxygen % saturation</b>	Range Resolution Accuracy	0 to 500% 0.1% 0 to 200%: $\pm 2\%$ air sat; 200 to 500%: $\pm 6\%$ air sat
<b>Dissolved oxygen mg/L</b>	Range Resolution Accuracy	0 to 50 mg/L 0.01 mg/L 0 to 20 mg/L: $\pm 0.2$ mg/L; 20 to 50 mg/L: $\pm 0.6$ mg/L
<b>Conductivity †</b>	Range Resolution Accuracy	0 to 100 mS/cm 0.001 to 0.1 mS/cm (range-dependent) $\pm 0.5\%$ of reading + 0.001 mS/cm
<b>Temperature</b>	Range Resolution Accuracy	-5 to +45°C 0.01°C $\pm 0.15^\circ\text{C}$
<b>pH, includes most low-ionic-strength measurements</b>	Range Resolution Accuracy	0 to 14 units 0.01 unit $\pm 0.2$ unit
<b>Non-vented depth, shallow</b>	Range Resolution Accuracy	0 to 30 feet (0 to 9 m) 0.001 foot (0.001 m) $\pm 0.06$ foot ( $\pm 0.02$ m)
<b>Non-vented depth, medium</b>	Range Resolution Accuracy	0 to 200 feet (0 to 61 m) 0.001 foot (0.001 m) $\pm 0.4$ foot ( $\pm 0.12$ m)
<b>Vented level</b>	Range Resolution Accuracy	0 to 30 feet (0 to 9 m) 0.001 feet (0.0003 m) 0 to 10 feet (0 to 3 m): $\pm 0.01$ feet (0.003 m) 10 to 30 feet (3 to 9 m): $\pm 0.06$ feet (0.01 m)
<b>ORP</b>	Range Resolution Accuracy	-999 to +999 mV 0.1 mV $\pm 20$ mV
<b>Salinity</b>	Range Resolution Accuracy	0 to 70 ppt 0.01 ppt $\pm 1\%$ of reading or 0.1 ppt, whichever is greater



YSI Model 5083 flow cell and 600XL. This is an ideal combination for groundwater applications.

### YSI 600XLM sonde

**Sampling Medium:** Fresh, sea or polluted water

**Temperature:** -5 to +45°C

**Computer interface:** RS-232, SDI-12

**Logging memory:** 384K flash ROM logs ~150,000 readings

**Software:** PC-compatible, Windows® 95 or higher;  
256K RAM minimum.

Graphics card recommended.

**Size:** 1.65" dia., 21.3" long (4.32 x 54.1 cm)

**Weight with batteries:** 1.5 lbs (0.7 kg)

**External power supply:** 12 VDC

**Internal power supply:** 4 AA-alkaline cells capable  
of logging for 75 days at one-hour intervals at 25°C

### YSI 600XL sonde

**Sampling Medium:** Fresh, sea or polluted water

**Temperature:** -5 to +45°C

**Computer interface:** RS-232, SDI-12

**Software:** PC-compatible, Windows® 95  
or higher; 256K RAM minimum.

Graphics card recommended.

**Size:** 1.65" dia., 16" long, 1.3 lbs.

(4.19 x 35.6 cm, 0.49 kg)

**External power supply:** 12 VDC

† Report outputs of specific conductance (conductivity corrected to 25°C), resistivity, and total dissolved solids are also provided. These values are automatically calculated from conductivity according to algorithms found in *Standard Methods for the Examination of Water and Wastewater* (ed 1989).

**SOP FOR MARK PRODUCTS 9822 HELIUM DETECTOR  
(OR EQUIVALENT)**

**Operating Instructions**

1. Keep Auto-Zero Ports on each side of the instrument free of obstructions during operation.
2. Maximum Sensitivity is achieved after a 25-minute warm-up.

**Calibration Procedure**

1. Connect the sample probe to the right side of the unit.
2. Press the ON/OFF switch once.
3. 5 minute count down begins.
  - a. SAMPLE, READ PURGE and SURVEY LEDs will turn on for 20 seconds.
4. Three beeps sound at end of the count down.
5. CAL is displayed and SURVEY LED turns on.
6. 00 is displayed.
7. Apply Calibration Gas to the sample inlet.
  - a. The display starts increasing in value and settles near the concentration value of the gas.
  - b. Remove the calibration gas.
8. Press the BATCH/SURVEY button.
9. CAL is displayed and the PURGE LED turns on.
10. 00 is displayed.
11. Apply the CALIBRATION Gas to the sample inlet.
12. Press the RUN button.
  - a. The display increases in value.
  - b. The SAMPLE LED turns on.
  - c. The READ LED turns on when the SAMPLE LED turns off.
  - d. The display locks near the concentration value of the gas.
  - e. The PURGE LED turns on when the READ LED turns off.
  - f. The PURGE LED turns off.





a Dielectric Pressurization Systems Company ♦ ♦ ♦ ♦

## Service & Support

[Service & Support NAV](#)[Reference Manual](#)[Trouble Shooting](#)[Warranty Info](#)

Mark Products  
Bridgton Commerce Center  
RR#2, Box 756  
Bridgton, ME 04009  
Tel: (207) 647-9495  
Toll Free: (877) 247-3797  
Fax: (207) 647-9496  
[info@marktel.com](mailto:info@marktel.com)

[Reference Manual](#)

### Battery Replacement Procedures For Mark Products Helium Detectors

#### Mark Models 1820A

1. Remove the four Phillips screws from the top; then remove the cover, straight up.
2. Remove the two small nut & bolts in the rear that's holding the battery bracket. Then remove the rear plate straight up.
3. Remove the battery connectors with long nose pliers; gingerly lay the resistor/connector unit forward (tip) and with a firm grasp, pull the battery straight up (it's on double stick tape).
4. Replace battery; making sure there are no kinks in the tubing or wires, and that the positive and negative wires are in the same position as when removed. Positive (orange) to the right facing the set.
5. Replace the negative connector first, then completely seat the resistor/connector unit and connect the positive lead.
6. Rebolt the back plate to the unit.
7. Replace the top straight down.
8. Replace the four Phillips screws snugly.
9. Recharge your set (overnight) to make sure your battery is at full charge.
10. Your set is ready for use.

#### Mark Model 9822

1. Remove the four Phillips screws from the top; then remove the cover, straight up.
2. Lift the battery holder/rear plate straight up and remove.
3. Un-plug battery using long nose pliers making sure to watch the positive and negative anodes (positive is to the right facing the set and is orange).
4. Then with a firm grip, pull straight up (it's on double stick tape).
5. Replace the battery - positive side right, pushing down firmly.
6. Replace battery holder/rear plate assembly, pushing straight down, making sure no wires or hoses are kinked.
7. Replace cover and tighten the four Phillips screws down snugly.
8. Recharge your set (overnight) to make sure your battery is at full charge.
9. Your set is ready for use.

**Battery for all models: Tempest Power Security Battery TR 1.9-12**

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## **SOP FOR RKI INSTRUMENTS EAGLE™ MULTI-GAS DETECTOR (OR EQUIVALENT)**

### **Purpose**

The RKI Eagle™ Portable Multi-Gas Detector will be used to detect carbon dioxide (CO<sub>2</sub>), oxygen (OXY), and methane (CH<sub>4</sub>) concentrations in vapor samples. This SOP summarizes procedures for the unit including operation and calibration.

### **Start Up**

1. Connect sample hose to inlet fitting.
2. Connect hydrophobic filter and probe tip to sample hose fitting.
3. Press and briefly hold down the POWER/ENTER button.
4. The Battery Voltage screen displays the minimum usable and actual battery voltage. If the battery voltage is too low, the instrument will not continue.
5. The instrument will then perform a self diagnosis and alert the user if a malfunction occurs. Upon successful completion of the self check, an "OK" message is displayed and the normal operating screen displays. The operating screen should display CH<sub>4</sub> (LEL%), OXY (VOL %), and CO<sub>2</sub> (ppm).

### **Normal Operation**

The instrument continuously monitors the sampled vapor and displays the concentrations of the target gases. In a low light environment, press any button to turn on the display backlight.

### **Monitoring Combustible Gas (Methane) in the PPM Range**

1. After startup, allow the combustibles sensor to stabilize (3 to 5 minutes). This stabilization period is required for ppm range operation.
2. Press the LEL/PPM button. The instrument will display PPM in place of LEL% for combustible gas.
3. If the PPM reading is not zero, take the instrument to a fresh air environment, then perform the demand zero procedure.
4. If the unit is calibrated to methane, the reading represents the methane concentration.

### **Monitoring CO<sub>2</sub>**

CO<sub>2</sub> is a background gas in fresh air. The unit will be equipped with a sensor having a detection range of 0 to 10,000 ppm. The approximate fresh air reading should be 400 ppm.

A CO<sub>2</sub> scrubber is mounted to the exterior front of the instrument. The scrubber is for use when setting the sensors zero reading only. Replace the scrubber if it turns from white to a violet color.

### **Setting Demand Zero**

1. Connect the CO<sub>2</sub> scrubber directly to the units inlet fitting.
2. Wait one minute for the fresh air sample to flow through the CO<sub>2</sub> scrubber, then press the AIR/▲ button to set the zero reading. If the CO<sub>2</sub> sensor fails when you press the button, use the zero control (marked F.ZERO) on the amplifier to adjust the reading to zero. DO NOT ADJUST THE C.ZERO CONTROL.
3. Remove the tubing from the CO<sub>2</sub> scrubber and probe.

### **Calibration**

Calibrate the instrument periodically to assure proper sensor response. A typical calibration frequency is once per month.

### **Calibration Supplies and Equipment**

- Four-Gas Cylinder
- Demand Flow Regulator

### **Procedure**

1. Take the instrument to a non-hazardous location with fresh air conditions.
2. Turn on the instrument and allow at least one minute for warm up.
3. Press and hold the AIR/▲ button until a tone sounds. The unit will automatically set the combustible gas and toxic gas to zero. Oxygen will be set to 20.9%.
4. Connect the regulator to the calibration cylinder.
5. Connect the calibration tubing to the regulator.
6. Press and hold the SHIFT/▼ button, then press the DISP/ADJ button. The calibration menu displays.



7. The menu includes two methods of calibration – auto calibration and single calibration. The Auto Calibration Method is described as follows.
8. Use the AIR/▲ and SHIFT/▼ button to place the prompt next to the AUTO CALIBRATION menu option.
9. Press the POWER/ENTER button to display the Calibration Values screen.

C	CH4	50	LEL%
A	OXY	12.0	VOL%
L	H2S	25.0	PPM
.	CO	50	PPM

The gas concentrations displayed in the Calibration Values screen must match the gas concentrations listed on the Four-Gas Calibration Cylinder. If *all* concentrations match, go to Step 7. If *one or more* concentrations do not match, continue with step 3.

10. To adjust the values on the screen, hold down the SHIFT/▼ button, and press the DISP/ADJ button. The Auto Calibration screen for the combustible gas channel displays.

AUTO CALIBRATION
<CH4>
50 LEL%

11. Use the AIR/▲ (increase) and SHIFT/▼ (decrease) buttons to set the correct combustible gas value.
12. Press the POWER/ENTER button to enter the new setting. The Auto Calibration screen for the next channel displays.
13. Repeat steps 4 and 5 to set the correct values for the remaining channels and return to the Calibration Values screen.

**NOTE:** The Four Gas Cylinder contains approximately 12% O<sub>2</sub> by volume. Be sure to set the "OXY" reading to agree with the concentration listed on the cylinder's label, not zero.

14. With the Calibration Values screen displayed, press the POWER/ENTER button. The gas readings flash.
15. Connect the tubing from the regulator to the probe. Wait approximately 1 minute or until the readings stabilize.
16. Press the POWER/ENTER button to set the calibration to the programmed values.

If a sensor(s) cannot calibrate to the proper value **FAIL PUSH AIR KEY** displays and

the instrument lists the sensor(s) that failed to calibrate. (The other sensors calibrate normally.) The buzzer and alarm lights activate. Press the AIR/▼ button to reset the alarm and return to the Calibration menu. Replace the failed sensor(s), then repeat calibration.

17. **AUTO CALIBRATION END** displays, then the Calibration menu displays.
18. Disconnect the tubing from the probe.
19. Unscrew the regulator from the calibration cylinder.
20. Press the SHIFT/▼ button to place the prompt next to the **NORMAL OPERATION** menu option, then press the POWER/ENTER button to return to the normal screen.

**Instruction Manual for RKI Instruments Eagle <sup>TM</sup> Multi-Gas Detector to be provided to field personnel.**

**SOP FOR DWYER THERMAL ANEMOMETER  
(OR EQUIVALENT)**

**Purpose**

A Thermal Anemometer is a hand-held, battery operated instrument for easily and accurately measuring both air velocity and temperature. The device is equipped with a permanently attached telescoping probe requiring a 7/16 " hole for insertion. For optimum accuracy, the tip must be extended at least 2 ½" and the two openings in the tip must be parallel to air flow. To assure proper alignment, note the orientation of the openings relative to the handle before insertion.

**Operation**

1. Press the ON/OFF key once to turn unit on. The unit will display velocity or temperature.
2. If a backlight display is needed first, turn the unit off, then press and hold the ON/OFF key down. After approximately 1 second, the backlight will switch on and remain lighted for approximately 2 minutes.
3. To switch between velocity and temperature, press the VELOCITY/TEMP key.
4. To change units, press the UNITS key.
5. To select a velocity range, press the range key until the desired range is shown in the lower left corner of the display. The unit will temporarily read zero until the sensor stabilizes.
6. If the LO BAT Indicator is displayed, replace the battery with a fresh 9-volt alkaline type such as Duracell® MN1604, Eveready® 522 or equivalent. Zinc carbon types are not recommended.

**Care and Cleaning**

1. Always cover the tip when not in use by fully collapsing the telescoping section.
2. Tip is fragile and must not be touched. Do not use brushes, cotton swabs, etc. to clean.
3. To clean, gently bathe the probe tip in a small container of denatured alcohol. Wash briefly and avoid extended soaking. Remove and gently shake off excess.



## MODEL 471-2 DIGITAL THERMO ANEMOMETER

### Physical Data – Operating and Cleaning Instructions



#### Introduction

The Dwyer Model 471-2 Thermo Anemometer is a hand-held battery operated instrument for easily and accurately measuring both air velocity and temperature. Four velocity ranges are selectable, reading in your choice of FPM (feet per minute) or MPS (meters per second). For temperature, units will indicate in °F or °C. The 471-2 includes a permanently attached telescoping probe which extends to 33 inches (83 cm). A 7/16" (11.1 mm) hole is required for full insertion. For optimum accuracy, be sure to extend the tip a minimum of 2 1/2" (6.36 cm) for all measurements. When extending or collapsing the tip, be sure the connecting cable moves freely through the opening at the base of the handle. Also note that the two openings in the tip must be parallel to air flow for best accuracy. A convenient way to assure proper alignment when tip is out of view—such as inside a duct—is to note the orientation relative to the handle before insertion.

#### Battery Installation

To install the 9 volt alkaline battery, first remove the two screws and end cap at the bottom of unit. Attach the battery clip to the battery and place it inside the case. Be careful not to pinch wires when putting battery in place. Replace cover and sealing gasket. If wrist strap will be used, install "Z" shaped clip under one of the screw heads before securing. Do not overtighten screws. Snap wrist strap to the clip.

#### On-Off Operation

The on-off control is a toggle function. Press the ON/OFF key once to turn unit on and again to turn it off. If the Model 471-2 is left on for approximately 2 1/2 minutes with no activity, the device will turn off automatically to conserve battery life.

#### Display Backlight

The Model 471-2 includes a standard backlight display to improve visibility under poor lighting conditions. The instrument must first be switched off before this feature can be activated. Next, press and hold the ON/OFF key down. After about 1 second, the backlight will switch on and remain lighted for approximately 2 minutes. It will then automatically shut off to conserve battery life.

#### Selecting Velocity or Temperature Measurement

To switch between velocity and temperature measurement, press the VELOCITY/TEMP key.

#### PHYSICAL DATA

##### Temperature Measurement

Ranges: 0 to 200°F (-17 to 100°C)

Temperature Accuracy: ±2°F, 1°C

Resolution: 0.1°

Ambient Temperature Limits: 32 to 140°F (0 to 40°C)

Storage Temperature Limits: -40 to 176°F (-40 to 80°C)

Power Source: 9 volt alkaline battery

Probe: 7/16" dia. (11.1 mm), length adjustable to 33" (83 cm)

##### Air Velocity Measurement

Flow Temperature Range: 32 to 200°F (0-100°C)

Range No.	Velocity, FPM	Velocity, MPS	Accuracy*
1	0-500	0-3.0	±3% F.S.
2	0-1500	0-7.0	±3% F.S.
3	0-5000	0-30	±4% F.S.
4	0-15000	0-70	±5% F.S.

\*Temperature limits for velocity accuracy specified are 59 to 86°F (15 to 30°C). Outside these ranges add 0.11% per °F (0.2% per °C).

#### Selecting Units of Measurement

The Model 471-1 will display velocity or temperature in either English or metric units. Velocity can be expressed in your choice of feet per minute (FPM) or meters per second (MPS). Temperature can be indicated in either °F or °C. Currently selected units will be indicated on the display. To change units press the UNITS key. Units selected will remain in memory even when power is shut off.

#### Selecting Velocity Range

Four velocity ranges can be selected in either English or metric units. Choose a range where typical readings fall within the center to upper portion of the span. The range selected will be shown in smaller characters in the lower left corner of the display. To change ranges, press the RANGE key until the required one is shown. Each time the range is changed, the displayed velocity will momentarily read zero until the sensor stabilizes with the new range.

#### Low Battery Indicator

A weak battery can cause improper operation and/or inaccurate measurements. A low battery indicator is included on the display to warn when the battery needs to be replaced. Although the unit might appear to operate and indicate properly, accuracy of readings cannot be assured when the LO BAT indicator is displayed. Replace the exhausted battery with a fresh alkaline type such as Duracell® MN1604, Eveready® 522 or equivalent. Zinc carbon types are not recommended because of their significantly shorter life and increased potential for leakage. Do not leave exhausted batteries in the unit due to possible leakage and resulting damage.

#### Probe Care and Cleaning

Always cover the tip when not in use by fully collapsing the telescoping sections. Use only in clean, dry particulate free air. Although probe requires little maintenance, occasional cleaning may be necessary for best accuracy. **Caution:** Tip is fragile and must not be touched. **Do not** use brushes, cotton swabs, etc. to clean. Remove battery before cleaning. Provide adequate ventilation and gently bathe the probe tip in a small container of denatured alcohol. Wash briefly, avoiding extended soaking. Remove from bath and gently shake off excess. Allow to completely air dry before replacing battery and returning to service. **Do not** use pressurized cleaners or compressed air, both of which could cause permanent damage.

**SOP FOR SKC DUAL BALL/FIELD ROTOMETERS  
(OR EQUIVALENT)**

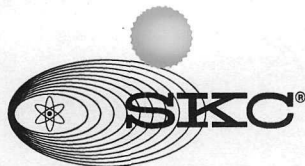
**Operation**

1. Operator rotometer in a vertical position to assure accuracy.
2. Connect the tubing from the monitoring well to the top of the rotometer.
3. If using a dual ball (dual range) rotometer, read the black ball on the rotometer until it goes off-scale, then begin reading the silver ball. Note that each ball has a separate scale.
4. If using a single range (field) rotometer, read the black glass or stainless steel ball.

**Maintenance**

Occasionally clean the rotometer if dirt appears in it or if float movement is restricted.

1. Remove the top plug, float stop, and ball float.
2. Wash the tapered hole, ball float, float stop, and top plug with a mild liquid detergent and a soft brush. Rinse all parts with clean water and dry thoroughly. Avoid using solvents.
3. Reinstall the ball float, float stop, and top plug. Use a small amount of (halocarbon grease or other compatible O-Ring lubricant to ease installation of the top plug.



## Operating Instructions

863 Valley View Road, Eighty Four PA 15330 USA

Tel: 724-941-9701 e-mail: skctech@skcinc.com

### Precision Dual Ball Rotameters 320 Series

These rotameter-style dual-ball flowmeters are designed specifically for the field calibration of air sample pumps. SKC rotameters are secondary standards and should be calibrated by the user with a primary standard calibrator at regular intervals. Since rotameters are affected by temperature and atmospheric pressure, rotameter calibration should be performed under the conditions of use or a mathematical correction should be used.

**Model 320-235-4600 (high flow)** has a dual range. Read the scale on the glass tube itself for the black (top) ball for a flow range of 225 to 2350 ml. Read the black and white scale at left for the silver (bottom) ball for a flow range of 500 to 5000 ml.

**Model 320-5-245 (low flow)** has a dual range. Read the scale on the glass tube itself for the black (top) ball for a flow range of 4 to 49 ml. Read the black and white scale at left for the silver (bottom) ball for a flow range of 24.5 to 245 ml. **Note:** Low flow rotameters can only be used with pulsation-free pumps.

**Model 320-5-4600 (low and high flow)** contains two dual ranges.

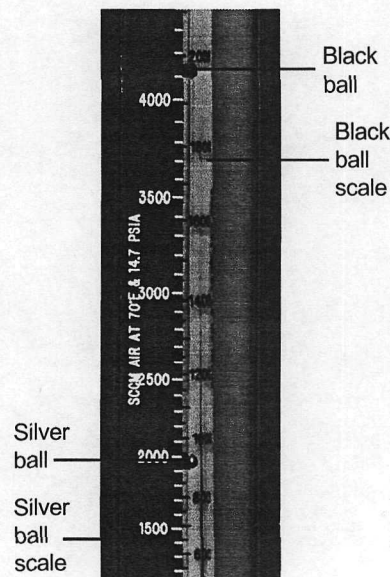
**On the left side:** Read the scale on the glass tube itself for the black (top) ball for a flow range of 4 to 49 ml. Read the black and white scale at left for the silver (bottom) ball for a flow range of 24.5 to 245 ml. **Note:** Low flow rotameters can only be used with pulsation-free pumps.

**On the right side:** Read the scale on the glass tube itself for the black (top) ball. This range is 225 to 2350 ml. Read the black and white scale at left for the silver (bottom) ball for a flow range of 500 to 5000 ml.

#### Operation

1. Using tubing, attach the top fitting (outlet) of the rotameter to the inlet of the sample medium.
2. Using another piece of tubing, attach the outlet of the sample medium to the inlet of the sample line between the rotameter and the pump.
3. Turn the pump on.
4. Read the black ball on the rotameter until it goes off scale, then begin reading the silver ball.

**Note:** Model 320-5-4600 contains two dual scales. When the black and silver balls have both gone off scale on the left side, begin reading the flow on the black ball, then the silver ball on the right side.



pump. The sample medium is now in-

#### Warning

Do not attempt to service this device.

Do not exceed 200 PSIG at 200 F. Operations at conditions beyond this point may cause rupture of the flowmeter and serious personal injury.

www.skcinc.com

Form #3750—Rev 0212

## Congratulations on your purchase of a quality SKC Calibrator —

In today's working environment, Occupational Health and Safety Management Systems include annual maintenance and calibration of all testing equipment. SKC offers you a recalibration service designed to verify that your calibrator is traceable to a primary standard.

#### Here's how SKC's Recalibration Service works:

- Call our Customer Service Team, 800-752-8475, to purchase this calibration service. Provide a purchase order number and Customer Service will furnish you with a return authorization number and other necessary information.
- Package glass items carefully, mark package "Fragile," and ship your calibrator to SKC Inc.
- Upon arrival, your calibrator will be recalibrated to a primary standard that is traceable to a NIST standard.
- A label will be placed on each calibrator to document the date of calibration and you will also receive a Certificate of Calibration for each calibrator.

#### The Benefits of Recalibration

- Accurate measurements of flow rates
- Adherence to Occupational Health and Safety Management Systems or company quality programs
- Documentation of traceability to a primary standard

**Note:** The frequency of recalibration is a function of use. The user is responsible to ensure calibration is maintained.



#### Shaping the future of air sampling

SKC Inc. • 863 Valley View Rd. • Eighty Four, PA 15330 USA

Phone: 724-941-9701 • Fax: 724-941-1369

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**Notice:** This operating instruction may not address all safety concerns (if any) associated with this product and its use. The user is responsible for determining and following the appropriate safety and health practices and regulatory limitations (if any) before using the product. The information contained in this document should not be construed as legal advice, opinion, or as a final authority on legal or regulatory procedures.



## Maintenance

Occasionally clean the rotameter if dirt appears in it or if float movement is restricted. To clean:

1. Remove the top plug, float stop, and ball float.
2. Wash the tapered hole, ball float, float stop, and top plug with a mild liquid detergent and a soft brush. Rinse all parts with clean water and dry thoroughly. Avoid using solvents.
3. Reinstall the ball float, float stop, and top plug. Use a small amount of halocarbon grease or any other compatible O-ring lubricant to ease installation of the top plug and prolong O-ring life.

## Specifications

Meas. Range (L/min)	Scale (inch)	Accuracy* ±	Subdivisions (L/min)	Cat. No.
0.05-0.5	2	5%	0.05	320-2A05
0.1-1.0	4	3%	20	320-4A1
0.4-5.0	4	3%	0.2	320-4A5
4-20	4	3%	0.5	320-4A20L
4-50	4	3%	1.0	320-440
5-30	4	3%	1.0	320-530**
3-30	4	3%		320-100†

\* Full Scale

\*\* Fittings adapted for use with HV30 Sample Pump

† Fittings adapted for use with QuickTake Sample Pumps

**Float:** Black glass or stainless steel ball

**Body:** Clear acrylic

**Seals:** Buna N O-ring

**Pressure:** 100 psig maximum

**Temperature:** 150 F (65 C) maximum

**Fittings:** Brass with hose connector, Tygon® tubing, and Luer taper adapter

Form #37505—Rev 0212

## Operating Instructions



863 Valley View Road, Eighty Four PA 15330 USA

Tel: 724-941-9701 Fax: 724-941-1369 e-mail: skctech@skcinc.com

## Field Rotameters

This rotameter is packed to protect against damage during shipment. If damage occurs, notify the carrier immediately. Also, check that you have received the correct model and flow range required for your application.

### Calibration

SKC rotameters are secondary standards and should be calibrated by the user with a primary standard calibrator at regular intervals. Since rotameters are affected by temperature and atmospheric pressure, rotameter calibration should be performed under the conditions of use or a mathematical correction should be used.

### Operation

Operate the rotameter in a vertical position to assure accuracy. Use it in a manner that minimizes vibration and flow pulsation; both conditions may affect the rotameter.

Flow rate is indicated by the point on the printed scale at which the center of the ball float comes to rest. The field rotameter inlet must always be at atmospheric pressure (i.e., exposed to the atmosphere). The rotameter is the last device connected to the sampling train. Connect the inlet of the sampling pump to the outlet of the sampling medium. Connect the inlet of the sampling medium to the outlet of the rotameter.

### CAUTION

**This rotameter is designed for use with non-hazardous gases at pressures up to 100 psig and temperatures up to 65 C (150 F). Do not use hazardous gases or liquids and do not exceed temperature or pressure limits. Use with hazardous fluids or beyond pressure and temperature limits may cause failure, which could result in personal injury.**

**SOP FOR FOXBORO TVA 1000 FID/PID  
(OR EQUIVALENT)**

**Purpose**

To provide a maintenance and calibration procedure for the Foxboro TVA 1000.

**Materials and equipment required**

Zero Grade Air (R-SGZA)  
Isobutylene Calibration Gas, 1000 PPM (R-SGISO-1000)  
Methane span gas, 1000 PPM (R-SGCH-1000)  
3 Tedlar bags (R-5L)  
Tygon tubing (R-TYC)

**Procedure**

1. Attach the handwand assembly to the unit. Also attach the sampling probe to the handwand assembly.
2. Ensure the hydrogen tank is full and insert into the unit.
3. Power on the unit. The unit will go through a power on self test.
4. Turn the hydrogen supply valve on.
5. Press the CONTROL button. Select the number 1 option to turn on the pump.
6. Let the unit warm up for 5 minutes.
7. Again press the CONTROL button, this time select option number 2, ignite flame. The pump will momentarily stop as the flame lights.
8. Press the number 1 key to select the Run Menu from the Main Menu. The display will show the units readings. This step also lets you know if the flame lit.
9. Let the unit warm up for another 20 minutes.
10. Press the EXIT key to return to the Main Menu. Select option 2, Setup. Next select option 5, other. Next select option 4, User Options. Next select option 3, Calibration Mode. Ensure the Calibration Mode is set to Automatic.
11. Press the EXIT key three times to return to the Setup menu.
12. From the Setup Menu select the calibration option, number 1, you are now in the Calibration Menu. First select option number 5, Response Factor, ensure both the PID and FID are both set to one. If not select option 1, Both, and enter 100 through the keypad and then press the ENTER key to accept the change.
13. From the Calibration Menu select option 4 Gas Concentration next. Select option number 2, PID. Enter the span value of your PID calibration gas, ensure this value matches your Isobutylene calibration span gas. Press the ENTER key to accept your value. The unit will return to the Calibration Menu.



14. Again select the Gas Concentration option number 4. This time select option 3, FID. Enter the span value of your FID calibration gas, ensure this value matches your Methane calibration span gas. Press the ENTER key to accept your value. The unit will return to the Calibration Menu.
15. Next select option number 1, Zero. Next select option number 1, Both. Fill a Tedlar bag with Zero Grade Air and attach to the instrument. Let the gas flow for 2 minutes. Press the ENTER key to start zeroing the instrument. After the unit has zeroed itself it will return to the Calibration Menu.
16. Now select option 3, Span. Select option 2, PID. This time fill a different Tedlar bag with Isobutylene Calibration Gas. Let the gas flow for 2 minutes. Press the ENTER key to start the calibration. After the unit has set it's span value it will return to the Calibration Menu.
17. Select option 3, Span, again. Select option 3, FID. Fill a Tedlar bag with Methane Calibration Gas. Let the gas flow for 2 minutes. Press the ENTER key to start the calibration. After the unit has set it's span value it will return to the Calibration Menu.
18. Press the EXIT key twice to return to the Main Menu. Select option number 1, Run. Ensure the unit reads below 5 ppm on both the PID and FID background readings. Apply the respective calibration gasses and ensure the units reads them with +/- 1% of the calibration gas value.
19. **END OF PROCEDURE.**

**Instruction Manual for Foxboro TVA 1000 FID/PID to be provided to field personnel.**

## SOP FOR SOIL VAPOR SAMPLE COLLECTION

The following procedure was developed as a method of collecting soil vapor samples that are representative of extracted soil gas. The procedure will consist of a vapor sample collection, field data measurements, and sample shipment.

### Vapor Sample Collection

Soil vapor samples will be collected using the integrated bag sampling procedure presented in USEPA Method 18, "Measurement of Gaseous Organic Compound Emissions by Gas Chromatography". The procedure will be completed as follows:

1. Connect the vacuum outlet of a rigid leak-proof container or "vacuum box" to the pump.
2. Label four Tedlar bags with the appropriate sample designation, date, and time.
3. Using Teflon tubing, connect a 1-liter Tedlar bag to the sample inlet in the interior of the vacuum box.
4. Using a second piece of Teflon tubing, connect the sample inlet connection on the outside of the vacuum box to the sample port on the vapor extraction line (sample source location).
5. Close the vacuum box, making sure the Tedlar bag is not pinched when shutting the case.
6. To collect a vapor sample, turn on the pump. The pump will evacuate the vacuum box, causing the Tedlar bag inside the box to fill with sample.
7. Viewing the bag inside the box through the window provided, shut off the pump when the Tedlar bag is approximately 80% full.
8. Disconnect the sample line from the Tedlar bag and confirm that the check valve on the bag is closed.
9. Repeat the above process three times resulting in a total of four Tedlar bag samples during the sampling event. Note: Additional Tedlar bags may be added if additional sample is needed for field measurements.
10. Protect each Tedlar bag from sunlight.
11. Place three of the four Tedlar bags inside the sample shipping container after confirming that each sample is appropriately labeled. Samples must be shipped to the laboratory via overnight courier each day. No ice or refrigeration of the samples is required.
12. Discard the piece of Teflon tubing connected to the sample inlet used to collect the four bag samples. Use a new piece of Teflon tubing for each subsequent sampling event.

Note that the vapor sample never passes through the pump, eliminating the possibility of pump contamination or sample contamination during future sampling events.

### **Field Data Measurements**

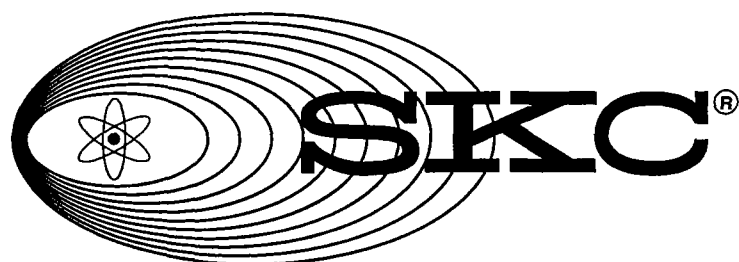
Field measurements of carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), oxygen (O<sub>2</sub>), and organic vapor concentration will be collected during each sampling event. CO<sub>2</sub>, CH<sub>4</sub>, and O<sub>2</sub> measurements will be made with a RKI Eagle gas monitor (or equivalent). Organic vapor concentrations will be measured with Foxboro TVA 1000 Flame Ionization Detector (FID)/Photoionization Detector (PID), or equivalent. Helium concentrations will be measured during AS pilot testing using a Mark Products 9822 Helium Detector. Each of the above instruments is equipped with a vacuum pump for drawing in a sample.

1. Confirm that each field instrument has been calibrated per manufacturer's instructions. Note calibration in the field logbook.
2. Opening the check valve on the Tedlar bag, connect the bag to the RKI Eagle monitor using the probe tip or Teflon tubing. Record the measured CO<sub>2</sub>, CH<sub>4</sub>, and oxygen concentration. Disconnect the Tedlar bag and close the check valve.
3. Opening the check valve on the Tedlar bag, connect the bag to the FID/PID using the probe tip or Teflon tubing. Record the PID and FID readings. Disconnect the Tedlar bag and close the check valve.
4. If measuring helium concentration, open the check valve on the Tedlar bag and connect the bag to the Helium Detector using the probe tip or Teflon tubing. Record the helium concentration. Disconnect the Tedlar bag and close the check valve.
5. Re-calibrate one or more of the above instruments per manufacturer's instructions if there is reason to question data obtained. Note calibrations in the field logbook.

### **Sample Shipment**

Vapor samples will be shipped to the laboratory as follows:

1. Vapor samples will be placed in the sample shipment container without ice.
2. If necessary, packing material will be used to prevent bags from puncturing during shipment.
3. Chain of custody forms will be placed in each sample shipment container.
4. The sample shipment container will be properly closed and sealed with packaging tape.
5. Sample shipping containers will either be hand delivered to the laboratory by field personnel or transferred to an appropriate shipping service for overnight delivery.



**Operating Instructions**  
**Universal Sample Pump**  
**Catalog No. 224-44XR**

**SKC Inc.**  
**863 Valley View Road**  
**Eighty Four, PA 15330**

*Form #37711 Rev 9912*

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## Description

The result of extensive research and development, the 44XR is a constant flow air sampler suited for a broad range of applications. It is ideal for industrial hygiene studies as well as environmental testing.

**Durable RFI-Shielded Case**  
provides protection from radio frequency interference between 27 and 1000 MHz.

**Rechargeable NiCad Battery**  
provides continuous 8-hour operation on a single charge.

**External Exhaust Port**  
for bag sampling.

**Low Flow Regulator**  
allows pump to be switched from high to low.

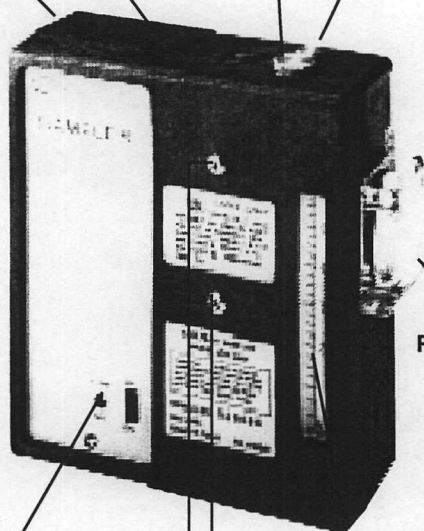
**Anti-tamper Cover**  
prevents inadvertent changes to settings.

**Recessed Flow Adjustment**  
adjust flow rate between 750 and 5000 ml/min.

**Accessory Mounting Screws**  
allow sampling accessories such as impinger holders to be secured to pump..

**Built-in Particulate Trap**  
in see-through housing protects pump.

**Built-in Rotameter**  
provides a visible check of relative flow rate during sampling, from 0.5 to 5 LPM..



## Specifications

<b>Operating Range:</b>	5-5000 ml/min (5-500 ml/min requires adjustable low flow holder)
<b>Weight:</b>	33 oz (936 gm)
<b>Dimensions:</b>	1-15/16 x 4-11/16 x 5-1/8 inches, 46.5 cubic inches (4.9 x 11.9 x 13 cm, 758 cubic cm)
<b>Compensation Range</b>	750 to 2500 ml/min—to 40 inches water back pressure 3000 ml/min—to 35 inches water back pressure 4000 ml/min—to 20 inches water back pressure
<b>Flow Control:</b>	±5% Set Point Constant Flow
<b>Run Time:</b>	8 hrs min at 4000 ml/min & 20 in water back pressure
<b>Flow Indicator:</b>	Built-in flow indicator with 250 ml division; scale marked at 1, 2, 3, 4, & 5 LPM
<b>Battery Assembly:</b>	Plug in battery pack, rechargeable NiCad 2.0 Ah, 6.0 V UL Listed.
<b>Intrinsically Safe:</b>	UL Listed for: Class I, Groups A, B, C, D; Class II, Groups E, F, G; and Class III. Temp Code T3C.
<b>Operating Temp:</b>	-20 C to +45 C (-4 F to +113 F)
<b>Storage Temp:</b>	-40 C to +45 C (-40 F to +113 F)
<b>Charging Temp:</b>	+5 C to +45 C (+41 F to +113 F)
<b>Operating Humidity:</b>	0 to 95% Relative
<b>Multiple Sampling:</b>	Built-in constant pressure regulator allows user to take up to four simultaneous samples at different flow rates up to 500 ml/min (total combined flow 1350 ml/min maximum) using optional low flow control.
<b>RFI/EMI Shielding Performance:</b>	Complies with requirements of EN 55022, FCC Part 15 Class B, EN 50082-1, Frequency range of the radiated susceptibility test was 27 MHz to 1000 MHz. CE approved.

# Operation

## **High Flow Applications (750-5000 ml/min)**

### **Setup**

Fully charge the battery by connecting the charger plug to the sampler charging jack (Figure 1, #15). Use only an SKC charger designated for this model. **CAUTION! DO NOT CHARGE IN A HAZARDOUS ENVIRONMENT.** Using 1/4 inch Tygon tubing, connect the sampling media to the pump intake (Figure 1, #6). Make sure the pump is set for High Flow. (See "Return to High Flow" p. 4).

### **Setting the Flow Rate**

Connect a flowmeter to the intake of the sampling media. Start the pump using the ON/OFF switch (Figure 1, #1), and set the flow rate using the FLOW ADJUST SCREW (Figure 1, #4). When the flow rate is set, turn the pump "off" and disconnect the flowmeter. Replace the sampling media used for calibration with new media for sample collection.

**Caution!** When using impingers, place an in-line trap between the pump and the impinger to protect the sampler from liquid or vapors. **FAILURE TO USE THE IMPINGER TRAP VOIDS THE WARRANTY.** The impinger and trap may be mounted to the sampler using the accessory mounting screws (Figure 1, #5).

### **Sampling**

For personal sampling, clip the sample collection media to the worker in the breathing zone. Start the sampling period by turning the pump "on", and record the start time. At the end of the shift, turn the pump "off" and record the stop time.

## **Low Flow Applications (5-500 ml/min)**

### **Setup**

Fully charge the battery by connecting the charger plug to the sampler charging jack (Figure 1, #15). Use only an SKC charger designated for this model. **CAUTION! DO NOT CHARGE IN A HAZARDOUS ENVIRONMENT.**

Start the pump using the ON/OFF switch (Figure 1, #1) and adjust the flow rate to approximately 1.5 LPM (Figure 1, #4 and #10). If performing multiple sampling using an adjustable flow tube holder (dual, tri, or quad), the flow rate of the pump must be greater than the sum of the flow rates through the tubes; the flow rate through any one tube cannot exceed 500 ml/min.

Remove the screw cap (Figure 1, #11) covering the regulator isolation valve. Turn the exposed screw 4-5 turns counterclockwise. Replace the screw cap. The pump is now set for low flow. Connect an adjustable low flow holder (Figure 2) to the pump intake



### **Setting the Flow Rate**

Connect a flowmeter to the exposed end of the sorbent tube. Loosen the phillips head screw on the low flow holder, and rotate the anti-tamper cover (Figure 2, #1) to expose the brass screw(s) (Figure 2, #2). Adjust the flow rate by turning the brass screw until the flowmeter indicates the desired flow. Do not adjust the flow on the pump. Adjust the flow only by using the brass screw (Figure 2, #2) on the low flow holder.

When the flow rate is set, turn the pump “off”, and disconnect the flowmeter. Replace the sorbent tube used for setting the flow with a new sorbent tube for sample collection. Place the appropriate size tube cover (Figure 2, #5) over the tube, and screw it in place on the low flow holder.

### **Sampling**

Clip the low flow holder to the worker in the breathing zone. Start the sampling period by turning the pump “on” (Figure 1, #1), and record the start time. At the completion of the test, turn the pump “off” and record the stop time.

### **Return to High Flow**

To return to High Flow, remove the screw cap (Figure 1, # 11) covering the regulator isolation valve. Turn the exposed screw clockwise until it stops. (Do not over-tighten.) Replace the screw cap. The pump is now set for high flow.

### **Bag Sampling by Positive Pressure**

Using 1/4 inch Tygon tubing, connect the sampling media to the pump intake (Figure 1, #6). (For sample bags using positive pressure filling, insert the exhaust fitting into the exhaust port, Figure 1, #12. After setting the flow rate, you will connect the sample bag to this fitting instead.)

# Preventative Maintenance

## Battery Pack Maintenance

**Removal**—Remove the two screws (Figure 1, #13) which secure the battery pack (Figure 1, #14) and loosen the four case screws above and below the belt clip. Carefully slide the battery pack out from under the belt clip (Figure 1, #16) being careful to keep it straight.

**Replacement**—Slip the front edge of the battery pack (Figure 1, #14) under the belt clip (Figure 1, #16) and rotate the battery pack so the rails engage the slots on the case front. Push the battery pack until it is properly located. Reinstall battery screws (Figure 1, #13) and tighten the case screws.

## Charge Maintenance

For proper maintenance of battery packs, SKC produces an optional cycling charger (Catalog No. 223-426) which discharges and recharges the battery automatically to protect against memory effects.

Rotate the use of any spare pack to avoid idle periods in excess of one month. Fully charge packs before or after use or storage.

SKC UL Listed Battery Packs (SKC Catalog No. P21661) contain a protective device to eliminate potential short circuiting while the pump is in use. If the battery pack becomes defective, the indicator light on the battery charger will not light while charging. Otherwise the charger or the wall outlet is inoperative. Process of elimination should indicate which unit is defective. If you are unable to determine which is defective, please contact SKC's Customer Service Department (724-941-9701) for further assistance.

**Caution: Do not charge in a hazardous environment.**

**Warning: Using a non-approved charger voids the SKC warranty.**

**Warning: Tampering with the battery pack voids the SKC warranty and the UL Intrinsic Safety listing.**

### **Pump Inlet Filter**

The SKC Sampler is fitted with a filter/trap inside the clear plastic intake port housing. This prevents particulates from being drawn into the pump mechanism. Occasionally, the filter should be visually checked to assure that it does not become clogged. If maintenance is necessary:

1. Clean all dust and debris from around the filter housing.
2. Remove the four screws (Figure 1, #7) and the front filter housing.
3. Remove and discard the filter membrane (Figure 1, #9) and o-ring (Figure 1, #8).
4. Clean the filter housing.
5. Insert a new filter membrane and o-ring.  
(Filter Replacement Kit, SKC Catalog No. P22409)
6. Reattach the front filter housing and cross-tighten the four screws.

### **Pump Service**

Pumps under warranty should be sent to SKC Inc. for servicing (see Service p. 12). For further information on pump maintenance, testing and replacing pump components, and troubleshooting, request the Universal Pump Service Manual (SKC Publication No. 1377).

*Notice: This operating instruction may not address all safety concerns (if any) associated with this product and its use. The user is responsible for determining and following the appropriate safety and health practices and regulatory limitations (if any) before using the product. The information contained in this document should not be construed as legal advice, opinion, or as a final authority on legal or regulatory procedures.*

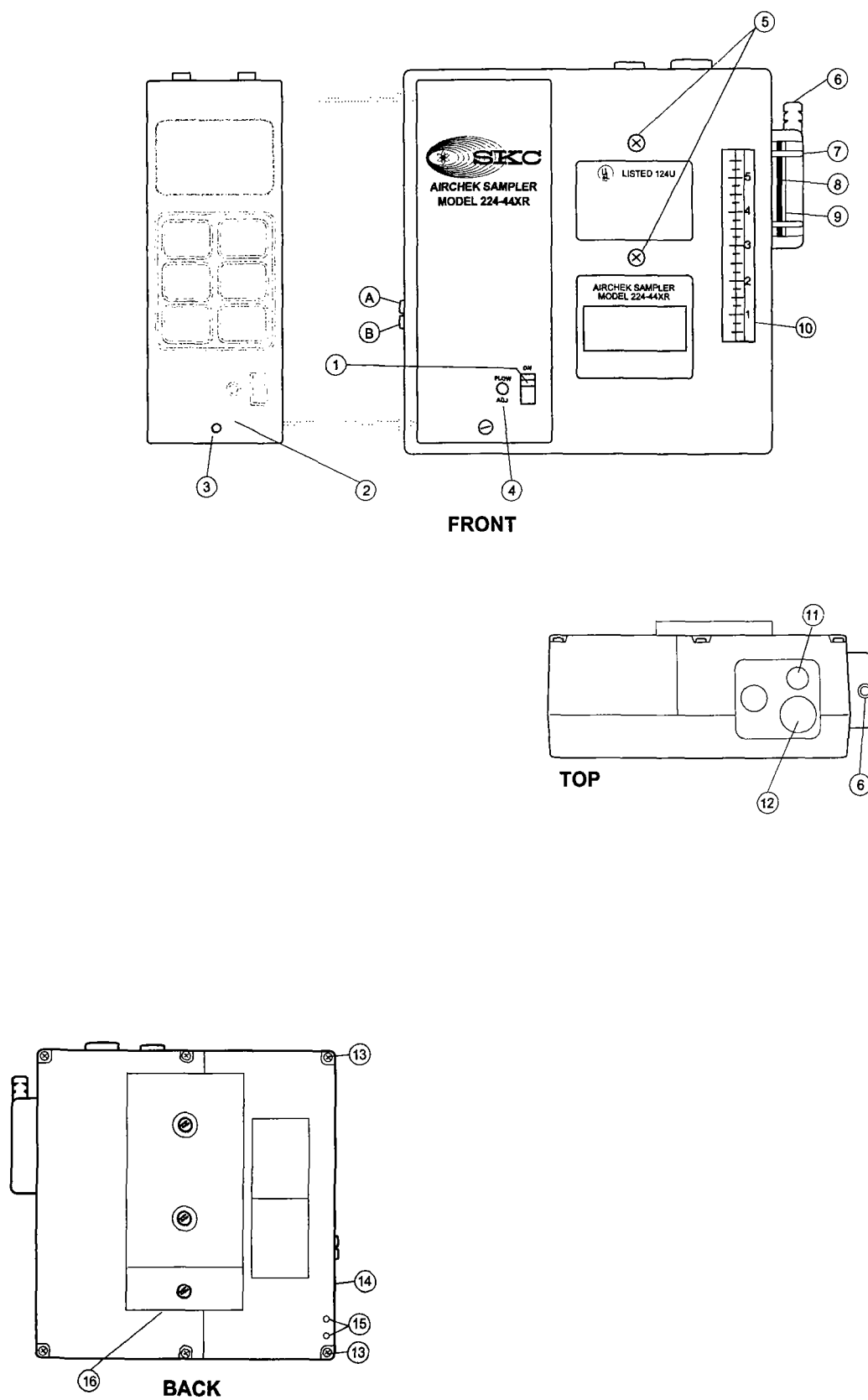
## **Diagrams/Part Description for Figure 1**

### **Model 224-44XR**

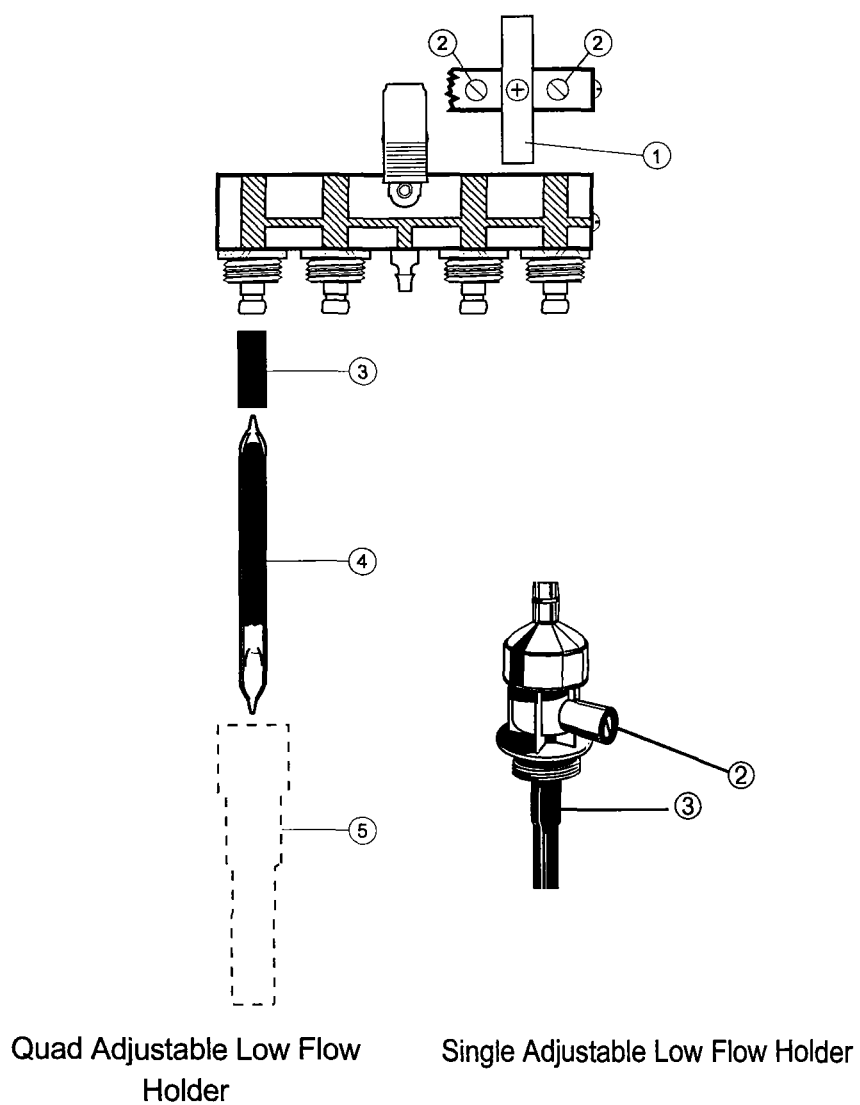
#### **No. Description**

- 1 **ON/OFF Switch**
- 2 **Anti-tamper cover.** Protects controls from accidental contact or tampering.
- 3 **Cover Screw.** Fastens anti-tamper cover.
- 4 **Flow Adjustment Control.** Adjust flow from 750-5000 ml/min.
- 5 **Accessory Mounting Screws (2).** Secure accessories such as impinger and trap holders.
- 6 **Filter Housing (intake).** Air intake port and trap.
- 7 **Filter Housing Screws (4).** Secure filter housing.
- 8 **Filter O-ring.** Leak seal for filter in housing.
- 9 **Filter (10 micron nylon).** Filters particulates before entering pump.
- 10 **Built-in Flowmeter.** Monitors flow changes.
- 11 **Regulator Isolation Cap.** Accesses regulator isolation valve.
- 12 **Exhaust Port Cap .** Accesses exhaust port.
- 13 **Battery pack screws (2).** Secures pack to pump.
- 14 **Battery Pack Assembly.** Provides power to pump.
- 15 **Charging Jack.** Connector for battery charger.
- 16 **Belt Clip.** Secures pump to worker.
- A **Compensation Pot A.** Adjusts pump compensation which is factory set. Access screw guards against accidental contact or tampering.
- B **Compensation Pot B.** Adjust pump compensation which is factory set. Access screw guards against accidental contact or tampering.

**Figure 1**



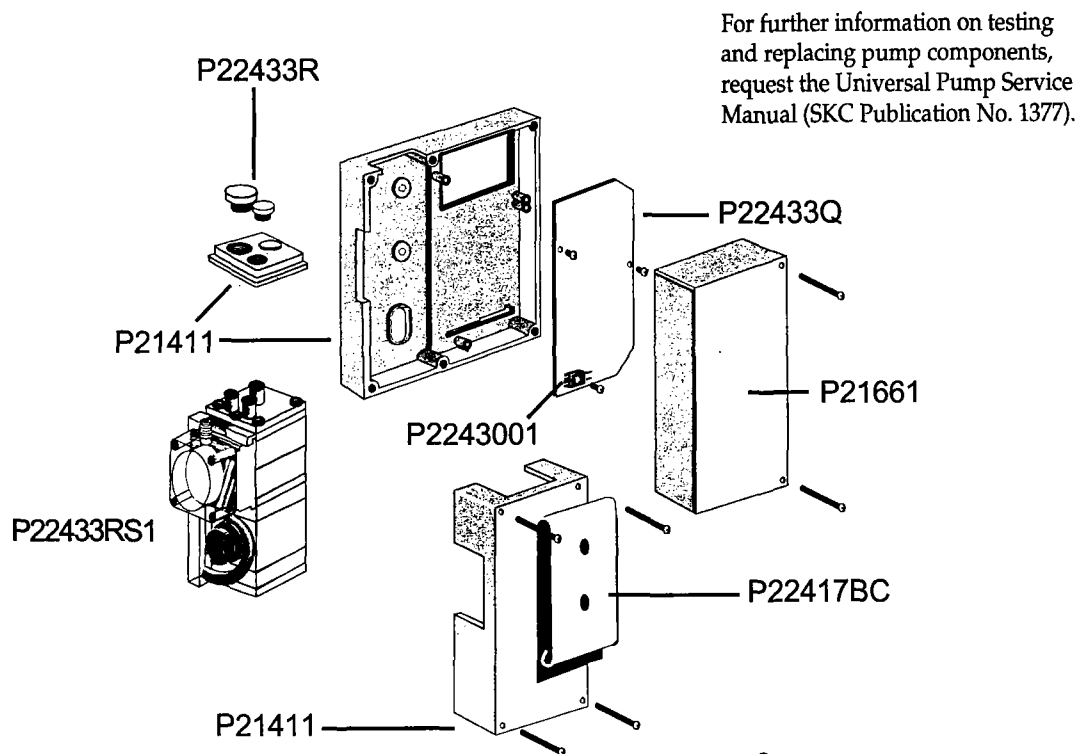
**Figure 2**



**Figure 2 - Adjustable Low Flow Holder**

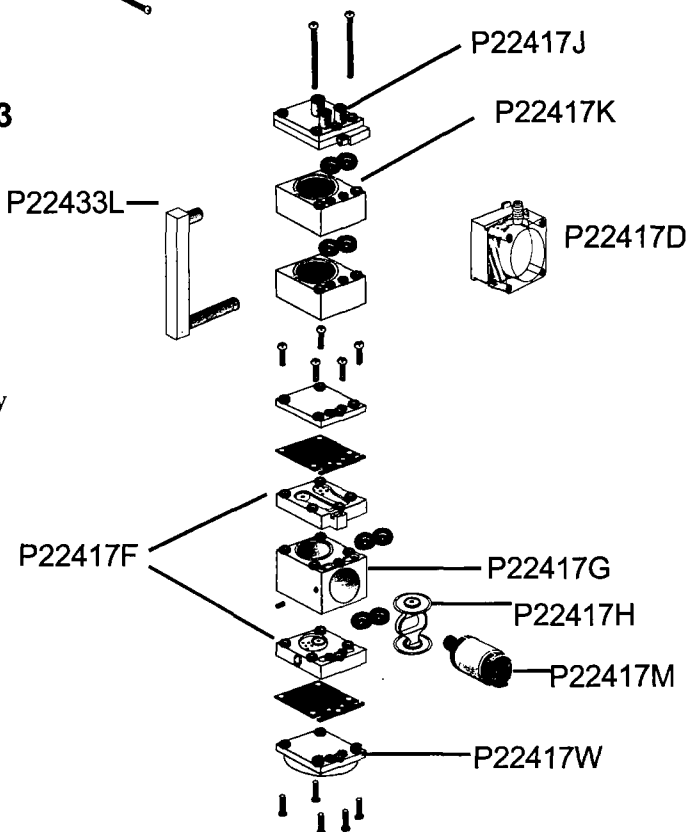
1. Anti-tamper Cover
2. Manifold Flow Adjustment
3. Rubber Sleeve
4. Sorbent Sample Tube
5. Protective Cover

# Figure 3 — Replacement Parts for 244-44XR



## Part Description for Figure 3 Replacement Parts

P22409	Replacement Filter Kit
P22433R	Cap Screws (set of 3)
P22417C	Exhaust Port Fitting
P22417D	Filter Housing Assembly
P22417F	Valve Plate Assembly
P22417G	Pump Body
P22417H	Diaphragm/Yoke Assembly
P22417J	Regulator Assembly
P22417K	Pulsation Dampener Assembly (2)
P22417M	Motor/Eccentric Assembly
P22417W	Bottom Plate Assembly
P21661	Battery Pack Assembly
P21411	Case Parts (Excluding Battery Case)
P22433L	Flowmeter Assembly
P22433Q	Control Board
P22433RS1	Replacement Stack
P21251	Half Stack
P2240901	Filters (pk/10)
P2240902	Filter/O-ring (100 ea)
P22417BC	Belt Clip
P2243201	Charging Jack (pk/5)
P22433C	Cover Plate
P22433ES	External Screws



Exploded view of stack # P22433RS1

## **Optional Accessories**

### **Adjustable Low Flow Holders:**

- 224-26-01 Single Holder
- 224-26-02 Dual Holder
- 224-26-03 Tri Holder
- 224-26-04 Quad Holder

### **Protective Sample Tube Covers:**

*for tubes up to:*

- 224-29A 70 mm long
- 224-29B 110 mm long
- 224-29C 150 mm long
- 224-29D 220 mm long
- 224-29T 115 mm with tandem trap tube cover

### **Battery Chargers:**

- 223-226 Single Battery Charger 115 V
- 223-227 Single Battery Charger 230 V
- 223-426 Deluxe 5 Station Battery Charger, Switchable for 115 or 230 V operation

### **Miscellaneous:**

- 224-11 Sampler Tool Kit
- 224-95 Protective Nylon Pouch with belt and shoulder strap, brown
- 224-95A Protective Nylon Pouch with belt and shoulder strap, red



## **Service Policy**

Product to be serviced should be sent, freight prepaid, to:

SKC Inc.  
National Service Center  
863 Valley View Road  
Eighty Four, PA 15330

Care should be taken in packaging to prevent damage in transit. Please include a contact name and phone number, shipping address, and a brief description of the problem. For nonwarranty repairs, a purchase order number and billing address is also required. The Service Center will contact nonwarranty customers with an estimate before proceeding with repairs.

## **SKC QualityCare**

QualityCare is a cost-effective preventive maintenance program that assures that pumps are tested, repaired, and calibrated on an annual basis. Participants will receive certificates of compliance for each pump, each year, to demonstrate adherence to Occupational Health and Safety Management Systems or company quality programs.

For more information on QualityCare call our SKC Customer Service Team at 724 941-9701.

**Note:** *SKC Inc. will accept for repair any SKC product which is **not** contaminated with hazardous materials. Products determined to be contaminated will be returned unserviced.*

## SKC INC. LIMITED ONE YEAR WARRANTY

1. SKC warrants that its instruments provided for industrial hygiene, air pollution, gas analysis, and safety and health applications are free from defects in workmanship and materials under normal and proper use in accordance with operating instructions provided with said instruments. The term of this warranty begins on the date the instrument is delivered to the buyer and continues for a period of one (1) year.

This warranty does not cover claims due to abuse, misuse, neglect, alteration, accident, or use in application for which the instrument was neither designed nor approved by SKC Inc. This warranty does not cover the buyer's failure to provide for normal maintenance, or improper selection or misapplication. This warranty shall further be void if changes or adjustments to the instrument are made by other than an employee of the seller, or if the operating instructions furnished at the time of installation are not complied with.

2. SKC Inc. hereby disclaims all warranties either expressed or implied, including any implied warranties of merchantability or fitness for a particular purpose, and neither assumes nor authorizes any other person to assume for it any liability in connection with the sale of these instruments. No description of the goods being sold has been made a part of the basis of the bargain or has created or amounted to an express warranty that the goods will conform to any such description. Buyer shall not be entitled to recover from SKC Inc. any consequential damages, damages to property, damages for loss of use, loss of time, loss of profits, loss of income, or other incidental damages. Nor shall buyer be entitled to recover from SKC Inc. any consequential damages resulting from defect of the instrument including, but not limited to, any recovery under section 402A of the Restatement, Second of Torts.

3. This warranty extends only to the original purchaser of the warranted instrument during the term of the warranty. The buyer may be required to present proof of purchase in the form of a paid receipt for the instrument.

4. This warranty covers the instrument purchased and each of its component parts.

5. In the event of a defect, malfunction, or other failure of the instrument not caused by any misuse or damage to the instrument while in possession of the buyer, SKC Inc. will remedy the failure or defect without charge to the buyer. The remedy will consist of service or replacement of the instrument. SKC Inc. may elect refund of the purchase price if unable to provide replacement and repair is not commercially practicable.

6. (a) To obtain performance of any obligation under this warranty, the buyer shall return the instrument, freight prepaid, to SKC Inc., at the following address:

SKC Inc., National Service Center  
863 Valley View Road  
Eighty Four, PA 15330 USA

(b) To obtain further information on the warranty performance you may telephone 412- 941-9701 at the address above.

7. This warranty shall be construed under the laws of the Commonwealth of Pennsylvania which shall be deemed to be the situs of the contract for purchase of SKC Inc. instruments.

8. No other warranty is given by SKC Inc. in conjunction with this sale.

*Form #3755 Rev 9612*